PB82-190257

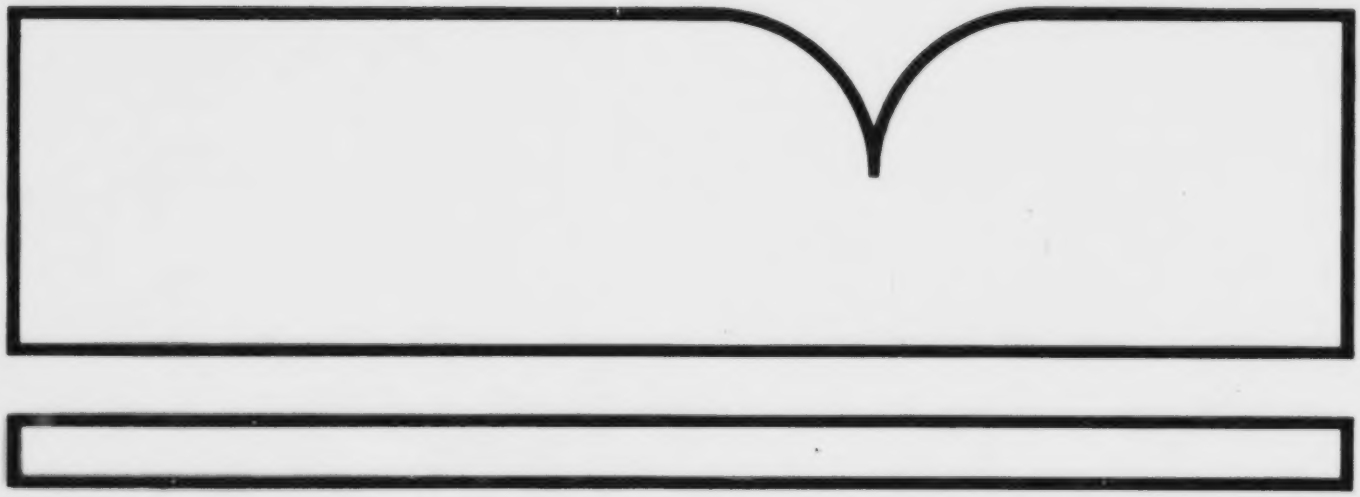
Draft Environmental Impact Statement City of Los Angeles Wastewater Facilities Plan. Addendum 3: Interim Sludge Processing and Disposal

Los Angeles City Dept. of Public Works, CA

Prepared for

Environmental Protection Agency
San Francisco, CA

Sep 77



U.S. Department of Commerce
National Technical Information Service
NTIS

50272-101

REPORT DOCUMENTATION PAGE	1. REPORT NO.	2.	3. Recipient's Accession No. PB82 190257

4. Title and Subtitle Draft Environmental Impact Statement City of Los Angeles Wastewater Facilities Plan Addendum 3 Interim Sludge Processing and Disposal

5. Report Date Sept. 1977

6.

7. Author(s)

8. Performing Organization Rept. No.

9. Performing Organization Name and Address

City of Los Angeles Dept. of Public Works
200 North Spring St.
Los Angeles, CA 90012

10. Project/Task/Work Unit No.

11. Contract(C) or Grant(G) No.

(C)

(G)

12. Sponsoring Organization Name and Address

U.S. Environmental Protection Agency
Region IX
San Francisco, CA 94111

13. Type of Report & Period Covered

14.

15. Supplementary Notes

16. Abstract (Limit: 200 words)

This EIS Addendum evaluates the proposed Los Angeles City Interim Sludge Project, a method for disposal of Los Angeles City's sewage sludge until the Regional LA/OMA Sludge Study determines how sludge from the entire Region would best be disposed of.

The proposed project would include construction, purchase and installation of equipment for: Centrifuging of sludge to remove most of the water, yielding a sludge cake with about 20% solids. Trucking of low moisture sludge to a sanitary landfill for disposal.

17. Document Analysis a. Descriptors

Sludge Disposal
Sludge Treatment

b. Identifiers/Open-Ended Terms

Los Angeles, California

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report)	21. No. of Pages 157
	20. Security Class (This Page)	22. Price

(See ANSI-239.18) *See Instructions on Reverse*

OPTIONAL FORM 272 (4-77)
(Formerly NTIS-35)
Department of Commerce

PB82-190257

DRAFT ENVIRONMENTAL IMPACT STATEMENT

CITY of LOS ANGELES
WASTEWATER FACILITIES PLAN

ADDENDUM 3

interim sludge processing and disposal

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U.S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA 22161

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
100 CALIFORNIA STREET
SAN FRANCISCO, CALIFORNIA 94111

AUG 19 1977

To All Interested Agencies, Public Groups, and Concerned Individuals:

We submit for your review and comment the Draft Environmental Impact Statement/Environmental Impact Report for the City of Los Angeles Wastewater Treatment Facilities Plan. This statement has been prepared in compliance with the National Environmental Policy Act of 1969 (P.L. 91-190), and implementing regulations promulgated by the Council on Environmental Quality and the Environmental Protection Agency. It has also been prepared in compliance with the California Environmental Quality Act and its implementing regulations.

The EIS/EIR summary and full report present the environmental, economic and social effects of wastewater facility planning decisions which will affect over 3.4 million persons living in the City of Los Angeles and contract cities, and involve capital costs in excess of 300 million dollars over the next five years.

The main purpose of this document is to publicize the long range environmental and social effects of wastewater facility alternatives so that citizens and governmental agencies can comment and express their concerns and preferences. Public comments are expected to play a key role in (1) selection of long-range alternatives for the services area, including size and location of collection and treatment facilities, and (2) implementation of measures needed to reduce environmental effects.

The Environmental Protection Agency, Region IX and the City of Los Angeles, Bureau of Engineering will hold hearings on the Draft EIS, approximately 30 days following the distribution of the EIS. The exact place and date will be announced. All interested parties are invited to express their views at the hearings. Persons wishing to make comments may submit them in writing and/or appear at the hearings. Oral statements will be considered, but, for the record, all important testimony should be submitted to:

Environmental Protection Agency, Region IX
Attn: Fred Krieger, W-1
100 California Street
San Francisco CA 94111

Enough copies of the written material should be provided so that other interested parties at the hearing may receive a copy. Oral statements should summarize extensive written material since it is necessary for all interested parties to be heard. After the public hearings the Draft EIS/EIR will be revised in light of the comments to form the Final EIS/EIR.

If you do not comment at the public hearings, you may send written comments to EPA at the address given above within thirty days following the hearings.

The following documents constitute the EIS:

Mini-Summary
General Summary
Main text (4 volumes)
Addendum 1. Reclamation Options
Addendum 2. Evironmental Analysis of Reclamation (available in October)
Addendum 3. Interim Sludge Processing and Disposal System
Appendices

Copies of these documents can be obtained by written or by telephone requests at the address given above or at:

City of Los Angeles, Bureau of Engineering
City Hall East-Room 650
200 North Main Street
Los Angeles, CA 90012 Attn: Fred Hoeptner
(213) 485-3089

Additionally the draft EIS and supplemental information may be reviewed at the above addresses or at the public libraries within the service area of the City of Los Angeles.

Please bring this notice to the attention of all persons who would be interested in this matter.

Sincerely,

for Clyde B. Eller, actg.
Paul De Falco, Jr.
Regional Administrator

EIS Addendum

Hyperion Sewage Treatment Plant

Interim Sludge Project

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Hyperion STP Interim Sludge Project
EIS Addendum

1. Summary:

1.0 This EIS Addendum evaluates the proposed Los Angeles City Interim Sludge Project, a method for disposal of Los Angeles City's sewage sludge until the Regional LA/OMA Sludge Study determines how sludge from the entire Region would best be disposed of.

1.1 Need for the Project

Los Angeles City has been directed by the SWRCB and the U.S. Environmental Protection Agency to cease ocean dumping of sewage sludge. Recognizing the importance of the ocean to the human environment, in 1970, a national (Presidential) policy was developed which called for discontinuation of ocean disposal of sewage sludge. Further, Title Four of the Federal Water Pollution Control Act (Public Law 92-500) provides for the development of ocean discharge criteria, and gives the Environmental Protection Agency the authority to regulate discharges using National Pollutant Discharge Elimination System (NPDES) permits. The NPDES permit issued for the City of Los Angeles Hyperion Sewage Treatment Plant requires termination of ocean discharge of sludge, because the discharge does not meet the requirements of Section 403(c). This section provides criteria which must be met to show an ocean discharge is safe or the permit for such discharge should not be issued. The State Water Resources Control Board, in developing its Ocean Plan as authorized under the Porter Cologne Act, in 1972, set requirements for disposal of treated sewage which established a prohibition on ocean disposal of sewage sludge. By 1980, Los Angeles City will have about 160 "dry tons" per day of sewage sludge to dispose of (about 6,400 tons before moisture removal).

1.2 Proposed Project: (Apparent Best Alternative):

The proposed project would include construction purchase and installation of equipment for:

1.2.1 Centrifuging of sludge to remove most of the water, yielding a sludge cake with about 20% solids.

1.2.2 Trucking of low moisture sludge to a sanitary landfill for disposal. The City of Los Angeles proposed trucking to a Class I landfill with the following order of preference: Palos Verdes, Calabasas, and BKK. Since the Palos Verdes Landfill will be filled and completed at approximately the same time as the interim sludge project becomes fully operational, Calabasas Landfill information is provided in this summary. EPA is not recommending any specific landfill site. However, EPA does recommend that impacts of trucking sludge to landfills be minimized by restricting hauling to a Monday-through-Friday schedule between 8 a.m. and 6 p.m.

1.3 Environmental Impacts:

1.3.1 Energy

The proposed project would consume electricity for centrifuging operations and diesel fuel for truck operations. Assuming Calabasas Landfill is used, the project would require about 2,100 barrels of oil per year by 1980, and about 7 million kilowatt hours of electricity per year for centrifuges.

1.3.2 Economics:

EPA has estimated a total operations and maintenance cost of $5 million per year. Capital cost is estimated at $12 million (if Calabasas Landfill is used). The EPA would pay for 75% of the capital cost, with the state and the city each paying 12 1/2%. The cost of this project would be about $2 per person per year.

1.3.3 Water Quality:

Assuming that sludge will be disposed of in a Class I sanitary landfill, no significant impact upon ground water or surface water is expected from disposal of sludge in the landfill.

Elimination of the sludge discharge through the seven mile outfall will have beneficial impacts upon ocean water, since heavy metals, chlorinated hydrocarbons and other substances in sludge will no longer be placed in the ocean. Removal of the nutrients provided by sludge to marine organisms may reduce local growth provided by this food stock.

1.3.4 Biological:

With disposal of sludge in a Class I sanitary landfill, and proper digestion and handling of sludge, no significant impact is expected.

1.3.5 Geological/Seismic:

Given the required investigation of geological and seismic factors at Calabasas before it was licensed as a Class I sanitary landfill, the placing of sewage sludge should not have significant negative impacts on the area's geology, nor should it initiate earth movement.

1.3.6 Air Quality:

This disposal method should not significantly affect air quality. Truck emissions are insignificant in view of the extremely large existing traffic volumes in this air basin. Odors might occasionally be noticeable, in the event of treatment plant malfunctions which inhibit proper stabilization of sludge.

1.3.7 Effect on Landfill Capacity:

The placement of sewage sludge for several years could, in the worst case, shorten the landfill's feasible life by a few months. If the sludge is mixed with cover material or if it fills voids in the landfill, it might have no effect whatsoever on landfill capacity.

1.3.8 Community Reaction:

Public concern has been primarily focused on the use of specific landfills for the disposal of sludge. Concerned elected officials and private

citizens, as well as chambers of commerce, had objected to use of the Mission Canyon landfill following City's publication of a Draft EIR, and to use of the Palos Verdes Sanitary Landfill for disposal of sewage sludge, following EPA publication of a Negative Declaration and the tentative notice of EPA intent to fund that project. Subsequently, a law suit was filed to enjoin EPA from funding the project.

1.3.9 Rare and Endangered Species:

A field study of the Hyperion Sewage Treatment Plant by a qualified professional shows that there are no rare or endangered species nor are there host plants on the Hyperion site. A rare and endangered butterfly, the El Segundo Blue, exists on properties to the north and south of Hyperion, on the host plant Eriogonum parvifolium.

1.3.10 Ecologically Sensitive Areas:

This project will not directly impact any wetlands, flood plains, fish hatcheries, bird sanctuaries or other environmentally sensitive areas.

1.3.11 Historic Preservation:

This project has been field checked by a qualified archaeologist and it was his determination that there are no cultural or historic features located in the direct impact zone. While each landfill has not been field inspected, the impacts of sludge disposal in a sanitary landfill would not be expected to change any impacts which might occur at landfills receiving only refuse. The staff of the State Historic Preservation Officer (SHPO) has concurred that there will be no effect on properties included on or eligible for inclusion on the National Register as a result of this project.

1.3.12 Noise:

The project should not significantly affect noise levels near the Hyperion Sewage Treatment Plant. Vehicle noise on Lost Hills Road near the Calabasas

landfill would occur as a result of hauling sludge between 8:00 a.m. and 6:00 p.m., Monday through Friday and may result in up to a 7 dB increase in the average noise level due to the increase in number of large trucks traveling on that road.

1.3.13 Employment:

U.S. EPA estimates that the project will result in the employment of approximately fifty-six people including operations, administrative, landfill and trucking staff, based on use of Calabasas landfill.

1.3.14 Construction Impacts:

Construction will cause small amounts of noise, dust, and additional traffic near Hyperion, which should not be noticeable except on the treatment plant site.

1.4 Mitigation Measures:

Environmental impacts which would result from the proposed projects do not appear to have major significance. Mitigation measures available for those impacts which would occur are described below:

1.4.1 Energy:

Trucks to transport sludge could have recently developed "fuel squeezer" engines, designed to increase mileage per gallon of fuel. Figures in Table 3-2 are based on use of these new engines, which increase fuel mileage by about 60% more than mileage from engines designed before the energy crisis. A decision by EPA has not been made to require this type of engine.

1.4.2 Air Quality:

Odors at the landfill site, and during trucking, will be minimized by careful plant operation and by a ban on shipping improperly stabilized sludge to the landfill site.

1.4.3 Landfill Capacity:

Sludge will take up less space in the landfill if it is mixed with the cover soil and used to cover refuse cells.

1.4.4 Social:

Any impacts which might be caused by a lack of information or by misinformation can be minimized by a large degree of citizen participation and by public input following distribution of this environmental document. Also, the public will have the opportunity to discuss and evaluate not only the proposed project but other alternatives, and to provide further input.

1.4.5 Noise:

Vehicle noise could be reduced to a minimum by using the most efficient mufflers available. Mufflers for large diesel engine vehicles are available which are said to reduce perceived noise from 25 to 35 decibels on the "A" scale, or would reduce noise to a level between 1/5 and 1/10 of the unmuffled exhaust pipe noise.* A decision has not been made to require this type of muffler.

1.4.6 Construction Period Impacts:

Construction impacts will be minimized by adequate supervision, and by the contractor's following all applicable local, State and Federal regulations concerning environmental impacts.

1.5 Alternatives to the Proposed Project:

Alternatives examined include methods for disposal of sludge "as is" from the digesters (with about 2 1/2% solids), and methods for disposal after dewatering. Basically, processes can be grouped into:

Reuse, including agriculture, silviculture, composting, soil reclamation, export.

Discard, including sanitary landfills, dedicated land and ocean disposal (including "no project").

Convert and discard residue, including incineration or pyrolysis of sludge, and the wet oxidation process.

*Donaldson Company, Inc., 1400 West 94th Street, Minneapolis, Minnesota, in a publication copyrighted in 1972.

Sludge process alternatives were compared on the basis of impacts in several areas. See Table 1.

One major criterion called for rejection of alternatives which would require a long time to implement, or which were not considered feasible to implement for only a few years. The proposed project is to be only for the interim period until the LA/OMA Study is completed, and should be restricted to reasonably available choices. Other criteria included biological, physical and social impacts including health effects, energy, economics, water quality, air quality, and the capacity for sludge disposal of the particular sludge process alternative.

The various alternatives and some of the more important environmental impacts are described in greater detail in Chapter 3. They are briefly repeated here, with the reason for rejection of the particular alternative.

1.5.1 Reuse:

All reuse methods involve land application of sludge in some manner, and all reuse methods include several common problems. Among these are:

1. The public, and grazing animals, must be kept from the land for some time after the last application.

2. Heavy metals require restriction of kinds of vegetation grown on such soil, or grown with sludge compost. Certain food crops cannot be grown, for health reasons. Research is being undertaken to develop better crop management and sludge application criteria.

3. Odors and bacteria from unstable sludge can create problems.

4. Regulations governing reuse of sludge have not yet been developed by the Department of Health. Those regulations may significantly affect any sludge reuse project.

While development of a reuse project in the immediate future is not possible due to institutional and social constraints which would be time consuming to overcome, the LA/OMA Project is giving serious consideration to the most promising reuse projects.

A major criterion for the selection of an interim project is the requirement that it have minimal impact, especially relevant due to the project's transitory nature. In general, reuse projects cannot meet this requirement.

Specific reuse processes have additional limitations, as noted in the sections below:

1.5.1.1 Agriculture

Sludge is too low in nitrates and phosphates to compete with commercial fertilizer; however, sludge is of value as a soil conditioner due to its humus value. There is little farming within 25 miles of Hyperion. Agriculture does not require fertilizing or humus continually, so sludge storage facilities would be required. Agricultural reuse of Southern California sludge is most applicable to a regional system where the high initial capital cost of long distance transport and storage facility can be shared by a larger base population. Because significant facilities investments would be required, agreements are needed with the sludge users to ensure that sufficient land would be available which could beneficially use sludge.

1.5.1.2 Composting:

Land, organic material and special equipment are needed, as well as marketing agreements. There is no readily available land near Hyperion for composting. LA/OMA Project is contracting for marketing studies which will determine the size of the potential market and develop a marketing strategy. A decision on whether to develop a composting proposal cannot yet be made; however, the dewatering and trucking facilities investment in the interim sludge project would continue to be needed with composting.

1.5.1.3 Soil Reclamation:

Nutrients and soil moisture could be good for the soil when preparing for agriculture on desert lands, but additional low-total-dissolved-solids water would probably be needed to prevent over-saline soil. Very high shipping costs for wet sludge would make it infeasible for an interim project.

1.5.1.4 Silviculture:

Application rates would be low, so much forest land would thus be out of use. It would stimulate growth of underbrush, increasing fire hazards. Additionally, this use would not be economically feasible.

1.5.1.5 Export:

This would remove sludge from the immediate area without maintaining control of its use. Depending on this use, export could amount to shipping Hyperion's problems to somebody else. Some of the proposals for export would involve some form of subsidized shipping; development of pier head facilities, purchase of tank cars, shipping or other types of facilities are needed. This could be expensive or if the user paid for transportation it could be very low cost. Export is not feasible in the short term and there is no apparent user, firm agreement, or method immediately available for sludge transport.

1.5.2 Discard:

All methods of discarding sludge have in common that they remove sludge from sight, smell, or opportunity for contact. Of course the constituents of sludge do not cease to exist, and often may remain essentially unchanged, but "out of sight, out of mind..." is a practice common in waste management as well as other areas of human activity.

1.5.2.1 Sanitary Landfills:

Use of sanitary landfills has several advantages. Landfills are currently available. They can be used as soon as trucks are provided and sludge is dewatered sufficiently for economic shipping. With well-located and well-operated landfills there should be no significant effect on the physical or biological environment outside the landfill. There is sufficient landfill capacity in the Los Angeles area so the interim project should not meaningfully affect the landfill capacity.

1.5.2.2 Dedicated Land:

Sludge application on land dedicated to only permanent use for sludge disposal would consist of applying sludge at very high rates on land and restricting its future use. Sludge disposal could be by lagooning, surface dumping, or soil incorporation. Crops would not be grown on the land and the site would be closed to the public during sludge application. There is less capacity per acre using this method than in sanitary landfills, because landfills usually consist of a pit or canyon with many layers each several feet deep while dedicated land is single-layered. Time required to acquire land for this purpose makes sludge disposal on dedicated land infeasible.

1.5.2.3 Ocean Disposal:

Ocean disposal, as currently practiced at Hyperion, harms certain marine organisms and may result in toxic buildups or bioaccumulation* in the food chain. It is not known how much waste the ocean ecosystems can absorb without irreversible damage. The possibility of deep ocean disposal (about 15 miles offshore and 3,000 feet deep) has been studied as a means of depositing sludge below the region of major biological activity, but the deepest existing wastewater outfalls in use are only about 300 feet below the surface.

*Bioaccumulation is the ability of organisms to directly or indirectly (by consuming prey) concentrate pollutants in their body tissues. The magnitude of bioaccumulation is determined by the nature of the pollutant, the species, its exposure, feeding habits, metabolic rate, age and size, quality of the water, and environmental conditions.

Energy and capital costs are lowest for the alternative of continued sludge disposal through the 7 mile outfall since no new construction would be needed and pipeline transport takes little energy.

Continued ocean disposal of sludge is in opposition to Federal and State policies and is unacceptable.

1.5.3 Convert and Discard Residue:

1.5.3.1 Incineration or Pyrolysis with Landfill Disposal of Ash:

These processes would require large amounts of heat obtained from petroleum-based fuel or possibly processed refuse. There are potential air quality problems, and dependability of air scrubbers on the incinerators is not too good; there is no record of a full scale long term incineration test which shows a system able to meet Air Pollution Control District standards in the Los Angeles Area.*

"Modern incinerators are considerably more sophisticated than earlier units, especially in air emissions control equipment," but "From the report prepared by the LAAPCD, it appears that the stringent air pollution rules and regulations existing in Los Angeles County would not yet permit operation of the newer units."**

1.5.3.2 Wet Oxidation:

This process amounts to a "wet burning" process, using a high temperature high pressure chamber. Still experimental, and having difficulty in being developed, it does not appear feasible for implementation.

---

* "Report on Status of Technology in the Recovery of Resources from Solid Wastes," County Sanitation Districts of Los Angeles County, January 13, 1976.

**Ibid.

COMPARISON OF SLUDGE PROCESS ALTERNATIVES

TABLE 1

Alternative	Biological or Physical Impacts	Social Impacts	Energy	Economics	Water	Air	Capacity	Ease or Speed to Implement	Other Factors
Agricultural	Bacteria/Heavy metals contamination, maybe. Specified crops excluded.	Odors if sludge unstable. Rejection of crop due to sludge "image", maybe.	Fuel to ship and to spread. liquid sludge fuel-intensive; 8x the volume of de-watered.	Not competitive with commercial fertilizer. Need nitrates, phosphates. Transport expensive.	Groundwater protection needed & prevent storm runoff to bodies of water.	Odors, insect pests, disease vectors, maybe, with unstable sludge.	Little farming in 25-mile distance from Hyperion STP.	Special equip't to ship & spread sludge needed plus contracts with farmers	Not usable year-round, requires storage or an alternate disposal method. Now no market for sludge. Would preempt land use for certain crops for years after sludge application is stopped.
Composting	Same as above & maybe health prob's from use by homeowners. Acreage unusable specified crops.	Same as above & can't be near homes or community's gathering places.	Fuel to ship, spread and mix, after dewatering.	Land & shipping cost. Will sell competitively for limited use	See above.	See above.	Not much land near Hyperion suitable for composting. Requires shipping to distant site.	Equipment needed as above plus land acquisition and relocation time needed.	Land use affected as above.
Soil Reclamation	Problems similar to agricultural or composting alternatives.	Public & grazing animals excluded from land for years after reclamation.	Same as for agricultural. fuel use depends on % moisture.	300,000 acres in southern Calif. could use sludge moisture. Costly to ship.	Use depends on keeping filtrate in root zone or no deeper than 10 feet.	See above.	Antelope Valley 90 miles away could be used as farmland with watery sludge.	Long-term project for a pipeline: prohibitive size for truck fleet.	May be feasible for LA/OMA solution with long-term payoff of capital investment. Not an economic short-term solution.
Silviculture	High growth rate of brush results from project, causing a fire hazard.	See above re: exclusion for health reasons.	See above.	Increased cost of fire crews with stimulated brush growth. Costly ship & spread.	See all above.	See above.	Low application rates require a large forested acreage.	Forestry must evaluate project. Interagency contract needed.	
Dedicated Land	Creates "blight" area which keeps expanding. Upen sludge dump not good sanitation.	Public rejection of method which doesn't remove sludge from view or from smell.	Fuel to ship and spread. Depends on economics if liquid or solid sludge is placed.	Land, shipping & spreading cost. Fencing probably yearly land additions.	Groundwater protection needed & prevent storm runoff to bodies of water.	See above; more acute problems with no soil cover on sludge.	No land zoned as dedicated in LA County. Public acceptance is doubtful.	Acquisition time plus public hearings.	As evaluated by LA/OMA, has less capacity than sanitary landfills, and no future use possible for land.
Sanitary Landfill	No significant change from current impacts of existing landfill.	Local protest if sludge is not stabilized, from neighbors and along haul route.	Shipping and mixing with soil after dewatering.	Dewater, ship & landfill fees.	Need approved site which protects groundwater & prevents surface water runoff.	No significant change from any other landfills.	Sufficient for several years of interim use without significantly taking up space.	Class I sites available now: Class II may be usable under right conditions.	Gas recovery and leachate collection systems needed at some landfills before sludge is placed. Public protest over use of Palos Verdes site. LA City rejected application to renew Mission Canyon use permit.
Incineration	See "air". Ash to dispose of. loss of nutrient & use of oxygen.		Oil or natural gas or other fuel required to burn sludge.	Capital costs & fuel & land for furnace site.	Ash disposal site must have groundwater and runoff protection.	Expect trouble meeting APCD standards. Air basin heavily smogged already.	Dependability of air scrubbers on furnaces not good.	Over a year to construct, test & operate. Public utilities won't give natural gas.	No record of full scale long-term incineration which shows a system able to meet APCD standards.
Ocean Disposal ("No Project")	Apparent cause, kelp beds dying, fin rot, tumors on fish, shellfish contamination.		Lowest energy... pumping through outfall.	Lowest cost.	Heavy metals & other toxic substances may build up in food chain. Worst water pollution.		Not known how much waste the ocean can absorb without irreversible damage to ecosystem.	Now being done.	Continuation of ocean disposal is, in effect, the "No Project" alternative. NPDES permit mandates an end to this by 1981.

1.6 Unavoidable Adverse Impacts if the Project is Implemented:

The impacts listed below are not considered significant. However, these are unavoidable adverse impacts and thus are discussed in this section. The impacts are more fully discussed in Chapter 3.

1.6.1 Energy:

Consumption of an average equivalent of 2100± barrels of oil per year after 1980 would result from this project. Consumption of an average of 7 million kilowatt hours per year for centrifuges would also result. Energy will also be required to handle the sludge at the landfill site.

1.6.2 Air Pollution:

Implementation of the project would result in approximately the following total daily emissions, based on trucking sludge to Calabasas:

Reactive hydrocarbons	.02 tons per day
Carbon monoxide	.09 tons per day
Nitrogen oxides	.18 tons per day

1.6.3 Water Quality:

Implementation would result in the removal of 160 tons of sludge from the ocean. The nutritional value of sludge would be lost to marine biota, as would the harmful portion of sludge which makes removal of sludge from the ocean a necessary act. There is currently an artificial situation created by the concentrated discharge of organic solids. The distorted ecology of the area would be expected, in time, to return to a more natural state following discontinuation of the discharge.

1.6.4 Economics:

The proposed project will cost approximately $12 million in capital cost in 1977 dollars, and $5 million per year operations and maintenance

cost based on Calabasas landfill, all of which will be at the taxpayers' expense and which cannot be spent for other programs if spent for sludge handling. It will also require several man-years of labor for planning, design, construction, operation and maintenance, which cannot be devoted to other plans if used for sludge handling.

1.6.5 Noise:

An increase in noise could be noticed on landfill approach roads between 8:00 a.m., and 6:00 p.m., Monday through Friday, due to the increased number of trucks going to the landfill.

1.7 Irreversible and Irretrievable Impacts Or Consumption of Resources Including Energy:

Most of the physical resources involved in this project (trucks, centrifuges, even the landfill space used) can be reprocessed and reused if desired; this will not necessarily be feasible in terms of energy, time or cost. One exception is energy; the energy resources consumed in construction of facilities and equipment, and in operation and maintenance, are not recoverable, to the extent that they are derived from fossil fuels.

Also not recoverable are "sunk costs," such as money and man-hours expended in planning, design, construction and operation. While these would presumably be expended in any case, use on this particular project precludes the use on other projects.

1.8 Short Term Uses Versus Long Term Productivity:

The most significant, immediate and long-term benefit of the project will be that the waters of Santa Monica Bay will no longer have the detrimental elements of sludge to absorb and react with. The toxic materials which have been discharged over the years will remain and still could bioaccumulate

in marine organisms for some years into the future. In the long term, the energy, manpower and landfill used should have no significant effect. This is an interim project, which is expected to operate for only a few years until the LA/OMA decision for sludge handling has been implemented.

1.9 Growth Inducing Impact:

This project is not expected to induce growth in the Southern California Area or elsewhere. It does not provide additional waste treatment capacity which could allow new connections; it does not provide a financial stimulus to growth; it does not cause changes of existing land use or of zoning. Because of a lack of growth inducing impacts this subject is not discussed further in the document.

Chapter Two: Introduction:

2.0 This document has been written by the Environmental Protection Agency to discuss and evaluate from an environmental perspective the various sludge management alternatives available to the City of Los Angeles.

This Addendum to the Los Angeles City Wastewater Facilities Plan Environmental Impact Statement completes the discussion of one of the most environmentally critical portions of the Facilities Plan. EPA's requirement for stopping the practice of ocean disposal of sludge has generated significant disagreement between Los Angeles City and the Environmental Protection Agency. EPA believes that it makes little sense to separate the solids from the sewage if both are to be discharged in essentially the same area.

Since 1969, active EPA encouragement of Los Angeles City to abandon its practice of discharging sludge through a seven mile ocean outfall into the Pacific Ocean has been met with increasing resistance. In August 1976, the City finally proposed an alternative to its current practice. However, at almost the same time, they demanded that EPA prepare an Environmental Impact Statement on this project. This Environmental Impact Statement Addendum is written to evaluate the Los Angeles City's August 1976 proposal to dewater sludge by centrifuge and haul it by truck to a Class I sanitary landfill.

2.1 Historical Background:

In 1957, Los Angeles City constructed and put into operation a seven mile long outfall for discharge of sewage sludge into Santa Monica Bay. Prior to this time the sludge was dewatered, dried, and sold as fertilizer. The change to ocean disposal was based on economic considerations. The discharge was designed as a buoyant plume, where the rising sludge was expected to mix and be diluted to the ocean currents. At that time, the remainder of the sewage was discharged only one mile offshore in 50 feet of water.

In the late 1960's, more concern for the environment arose. In viewing the Hyperion sewage treatment plant, it became obvious that there was little environmental benefit gained from taking solids out of the sewage, then putting the partially treated water into one pipe and the solids in another, and finally, pumping both the solids and the partly treated sewage out into the ocean.

In 1969 the City of Los Angeles informally agreed to cease the practice of sludge disposal to the Ocean. Starting in March 1971, the Environmental Protection Agency based several grants to Los Angeles City for wastewater treatment facilities construction on the condition that Los Angeles City proceed with plans to discontinue dumping sludge into the ocean.

In 1972 three Federal and State actions reflected a firm governmental determination to bring a rapid halt to ocean disposal of sludge. The State Ocean Plan, adopted July 1972, established discharge concentration limitations on metals, oil and grease, suspended solids, turbidity, and chlorinated hydrocarbons, not all of which could be met by Los Angeles City sludge. It also established an outright prohibition on discharge of sludge. The Federal Water Pollution Control Act, enacted in October 1972, established secondary treatment as the minimum nationwide level of pollution control required for all discharges from publicly-owned wastewater treatment works; this would implicitly prohibit discharge of sludge. Finally the Federal Marine Protection Research and Sanctuaries Act, enacted October 1972, extremely restricts ocean dumping of sludge.

In December 1972, after passage of the Federal Water Pollution Control Act and the Federal Marine Protection Research and Sanctuaries Act and adoption of the California State Ocean Plan, Los Angeles City adopted a schedule for discontinuance of ocean disposal by the end of 1976. By that schedule a project report was due in August 1973. The report was not received until April 1974. It presented two alternatives with no recommendation. The report was sent back as deficient as it had not thoroughly evaluated the most viable options.

In August 1974, the City asked for an extension of their December 31, 1976 date to have sludge out of the ocean. Both EPA and the State Water Resources Control Board denied the request.

In February 1975, meetings were held with Los Angeles City to discuss acceleration of many of the City's wastewater treatment construction projects as a part of Governor Brown's statewide effort to reduce unemployment and help the economy. The condition that the City act on getting sludge out of the ocean was heavily emphasized.

In April 1975, a Project Report on the Interim Sludge Processing and Disposal System was issued.

In September 1975 an NPDES permit was issued by EPA for the sludge discharge, setting interim dates for getting sludge out. The SWRCB also issued a permit for this discharge, under the Porter-Cologne Act. The original December 31, 1976 deadline for stopping the ocean discharge of sludge was extended to April 1, 1978 in these permits and later was further extended, by the SWRCB only, to April 1, 1980.

In October 1975 concept approval was given by SWRCB on the City's proposal. The City Council delayed for ten months approving the Final Environmental Impact Report for the Interim Sludge Project, until August 1976.

The Environmental Protection Agency approved the project in November 1976 by issuing a Negative Declaration, recognizing that at a very low per capita cost a significant improvement in the water quality would be achieved. In December 1976, the City requested that EPA prepare an Environmental Impact Statement and in February 1977 four Los Angeles City Council members acting as private citizens brought suit against the Environmental Protection Agency to require preparation of an Environmental Impact Statement. The lawsuit also challenged State and Federal authority to require improved treatment for discharge into the ocean.

2.2 Issues of Concern:

There are a number of issues which have been identified by the Environmental Protection Agency and the groups which requested preparation of the Environmental Impact Statement. These have been categorized as follows: Landfill impacts, sludge transportation impacts, impacts at the Hyperion treatment plant, and ocean disposal impacts.

Areas of concern regarding landfill disposal include: Noise, odors, hours of operation, leachate production, subsidence, seismic failure, landfill gas hazards to nearby residences, landfill gas impact on air quality, energy consumption and air emissions of landfill vehicles, economic impacts of the early closing of Palos Verdes landfill, and consideration of landfill sites located within Los Angeles City boundaries.

Areas of concern regarding truck hauling of sludge include: Noise, traffic congestion, wear on local streets, hours of hauling, energy consumption, and air emissions.

Primary concerns relating to Hyperion include: noise and dust impacts during construction, and the operating impacts of chemical usage, air emissions, and energy consumption.

The major concerns of ocean disposal include: Abnormalities of marine organisms, productivity of fisheries, deep ocean basin dumping, toxicant levels in sludge and bioaccumulation of toxic substances in the marine environment.

While the above listed concerns are not all of equal importance they have all been addressed, often in a qualitative manner where quantitative comparisons would have been quite difficult to make.

2.3 Relationship to Other Reports:

This document, as an Addendum, frequently references the body of the Draft Environmental Impact Statement for the City of Los Angeles Wastewater Facilities Plan, particularly for the "no project" description details. While the main body of the Environmental Impact Statement covers the wastewater upgrading alternatives, it omits coverage of the alternatives for handling and disposing of the solids (or sludge) removed from the wastewater. This Addendum adds that coverage.

The City of Los Angeles prepared a project report and an Environmental Impact Report on Hyperion Treatment Plant Interim Sludge Processing and Disposal System from which this Addendum draws significantly for information on sludge processing and disposal alternatives. The emphasis of environmental analysis in this Addendum is on the City's recommended project, i.e., dewatering and landfill of sludge.

An initial analysis of candidate systems was prepared for the Los Angeles/Orange County LA/OMA Sludge project, and additional analyses on a wide range of long term sludge management systems will be prepared in the next year and a half. The LA/OMA results will be used to determine the long range solution for the Region's sludge management problems and will provide a much more complete analysis of the options which were not viable for immediate implementation.

2.4 Problems to be Corrected by the Project:

Besides the obvious consideration that it makes little sense to take solids out of sewage if the solids are going to be disposed in essentially the same place as the cleaned up wastewater, there are other reasons for not wanting the sludge disposed of in the ocean.

The present sludge discharge has resulted in significant adverse impact in the area relatively near the discharge, even though probably 4% or less of the sludge solids remain deposited there. The ecology of the bottom sediments is significantly altered, with only a few pollution-tolerant species able to survive. In the water above the discharge, fish are attracted to the area for feeding on the discharged material, probably on the high concentration of worms in the sediment and on other fish grazing in the area. At least two species of fish in this area have, in significant proportions (about 10% of fish nearest outfall), a disease called either "fin rot" or "fin erosion." This disease definitely appears to be discharge-related, although the specific cause is unknown at this time.

Sludge contains numerous potentially toxic or carcinogenic substances including mercury, cadmium, and PCB's. Because 90% or more of the sludge does not settle near the discharge point but is apparently widely dispersed, the impacts cannot be controlled once the material has been released.

Bioaccumulation (buildup of toxic materials in living organisms) is a method by which chemicals could concentrate to dangerous levels in fish, birds, mammals or even in man. This is apparently what happened in the case of the Brown Pelican and California Sea Lion reproductive failures in 1970, with DDT apparently being the bio-accumulated chemical which caused thin egg shells and premature births. Because of the various toxic materials found in sludge, it is feared that undesirable bioaccumulation may now be occurring in certain species from sludge discharge and may again do irreversible damage.

2.5 Project Proposed by Los Angeles City:

In order to eliminate the disposal of Hyperion sludge to the ocean, the City has proposed, as its interim project to dewater the sludge, using solid bowl centrifuges which would be installed in the existing unused filter building. The sludge would still be 80% water, but the water content would be reduced to the point that the solids would look and behave more like a damp soil than a thick mud. This dewatered sludge cake has been proposed to be placed in a Class I sanitary landfill. Sludge would be hauled in large diesel-engine trucks with trailers. By 1980, nearly sixty trips per day would be required on week days. The City did not specify routes to be taken by the trucks; however, this Addendum analyzes the most likely routes to the various landfills in Los Angeles County which could conceivably accept Los Angeles City sludge.

Chapter Three: Alternatives and Impacts

3.0 Twenty-six alternate processes involved in sludge disposal were evaluated. The various possible combinations of these processes number in the hundreds; most project alternatives involve at least two processes.

3.0.1 Because of the large bulk of sludge requiring daily disposal (1-1/2 million gallons a day) it might be desirable to remove some of the water from the liquid sludge before further processing or shipping. Included in alternatives studied are First Order Dewatering, which would remove water from the liquid (2-1/2% solids) sludge. First Order Dewatering processes include Centrifuges, Sand Drying Beds, Pressure Filters, and Vacuum Filters.

Second Order Dewatering processes would remove more water from sludge which has already been through one dewatering process. Some second order processes may also render the sludge biologically inert, through physical or chemical means. Second Order Dewatering processes include Flash Dryers, Multiple Hearth Furnaces, Rotary Dryers, Rotating Gravity Concentrators,

Moving Screen Concentrators, Capillary Dewatering, Basic Extractive Sludge Treatment, and Oil Emersion Dehydration.

3.0.2 Following any dewatering processes used, disposal alternatives are divided into groups of processes which discard sludge, reuse sludge, or processes to convert and discard sludge. Discard processes include Sanitary Landfills, Dedicated Land, Deep Ocean Disposal, and Export. Reuse processes include Soil Conditioner, Incorporation into Chemical Fertilizers, Composting, Piping to Desert, and Reforestation and Range Improvement. Convert and Discard processes include Pyrolysis, Incineration, and Wet Oxidation.

3.0.3 Consideration of the "No Project" alternative, involving continuation of the existing discharge of sludge through the Seven Mile Outfall, is examined in detail in Chapter Four, "Ocean Disposal of Hyperion Sludge."

3.1 Dewatering Processes:

Depending on its source, sludge coming into a dewatering process usually has from 4/10% to 8% solids. For economy and to make it easier to handle the sludge, it may have most of the moisture removed for easy disposal or further treatment.

First Order Dewatering

For study purposes, dewatering processes are divided into: First Order Dewatering Processes i.e., those processes which start with high-moisture-content sludge, such as centrifuging, drying beds, filters: and Second Order Dewatering Processes, which could be used on medium-moisture-content sludge that has already undergone first order dewatering.

3.1.1 Centrifuges:

3.1.1.1 Process:

In the centrifuging process, solids are separated from liquids in a rapidly spinning drum which separates the denser portions from the less dense

portions by centrifugal force. The resultant sludge cake contains from 6% to 35% solids, (LA/OMA Study) based on the type of centrifuge used and type of sludge. In the LA City EIR, it is assumed that their equipment is capable of producing a sludge cake with 20% solids. Depending on the type of centrifuge and sludge, the addition of polymer often aids in the quick separation of moisture from solids.

3.1.1.2 Subsequent process

The sludge cake is transported to further processing or to its ultimate destination, following the centrifuge operation.

The centrate, which contains a high level of Biochemical Oxygen Demand and Total Dissolved Solids, would be returned to the treatment plant headworks for recycling, would go to the longterm LA/OMA-developed disposal option, or would be sent out to sea in the seven-mile outfall until such time as the LA/OMA option is implemented. Ocean disposal of centrate is not desirable because the centrate

contains about 10% of the sludge solids, which contain toxic metals and halogenated organic compounds which are undesirable for ocean discharge.

3.1.1.3 Centrate Treatment

Centrate discharge in the Pacific Ocean is not desirable because of the increased difficulty in meeting the Ocean Plan and secondary treatment standards. Centrate co-mingled with effluent would result in a mixture with an additional 15 milligrams per liter of suspended solids.

As stated in the LA City EIR and facilities plan, secondary sludge has about 2 1/2% solids, as does the mixture of primary and secondary sludge expected for this project. Allowing for 80% moisture retained in the sludge cake, every eight tons of wet sludge would yield seven tons of centrate and one ton of sludge cake with 20% solids. This amounts to 5,600 tons of centrate per day with about 0.3% solids content.

Current practice includes secondary treatment for 100 MGD of Hyperion's sewage; although there would

not be a great deal of mechanical difficulty in just adding the centrate at the headworks and recycling it, pretreatment may be necessary.

The centrate would have about 2900 mg/liter of suspended/dissolved solids and high BOD, and would contain no oxygen. Most of the biomass in the suspended solids would include dead cells.

Recycling of centrate from digested sludge could inhibit the normal activated sludge process. Digestion increases the concentration of dissolved heavy metals; recycling of the centrate without removal of these metals could mean a steady increase of concentration until the activated sludge could not function properly.

One recommended method to handle centrate is to precipitate heavy metals with lime treatment and to provide aeration for BOD reduction. Centrate could then be recycled at the headworks with less effect.

3.1.1.4 Impacts -- Direct:

Capital costs for centrifuges, depending on the type, would be from $1.25 million to $6 million for 160 tons per day of dry solids. This is derived from data available from the LA/OMA Study. The O&M cost for operating the centrifuges would be from $215,000 to $950,000 per year for 160 dry tons per day of solids.

3.1.1.5 Energy required to operate the centrifuges is estimated at .97 horsepower per gallon per minute of wet sludge. 160 tons of dry sludge comes to about 1.5 million gallons of wet sludge per day with about 2 1/2% solids, which would require about 1050 horsepower to treat, or about 7 million kilowatt hours per year.

3.1.1.6 Air pollution should not be a significant direct impact of sludge dewatering. Electricity for operating centrifuges could come from the Los Angeles Department of Water and Power tie with Boulder Dam hydroelectric generation facilities. However, most power used in the City of Los Angeles is generated with steam from low-sulfur bunker

fuel oil combustion. In the worst case, all power for operating centrifuges could come from oil combustion. The following quantities of air contaminants would be produced at the power plant while generating electricity for the centrifuges.

TABLE XLVIII

POUNDS PER DAY OF POLLUTANTS

CO	NO_x	SO_x	HC	PARTICULATES
3.8	43.2	49.8*	3.4	7.5

Emission factors from Table XLVIII, Air Quality Handbook for Environmental Impact Reports, July 1976, South Coast Air Quality Management District.

* Based on oil with a maximum of 2.5% Sulfur by weight, as required in L.A. area.

3.1.1.7 As a result of available noise reduction technology noise should not be a significant as a result of centrifuge operation, except possibly for noise inside the centrifuge building on the Hyperion Plant site. The facilities will conform to the City of Los Angeles noise ordinance. Employees in the building will be provided with any needed protection against noise as required by Cal-OSHA.

3.1.1.8 There should be no significant impacts on water quality as a result of centrifuging operations, except the possibility that centrate returned to the treatment plant could possibly adversely affect the secondary treatment process. This could affect effluent quality, causing impacts on ocean water; preventing this could require additional construction for centrate treatment. Part of the reason for this potential is the high proportion of industrial waste in the Hyperion Treatment Plant sludge. Appropriate handling of centrate could include such things as step treatment, additional aeration, or other methods.

3.1.1.9 Construction impacts associated with the centrifuge facilities include those from the demolition inside the centrifuge building and from constructing the centrifuge facilities, installation of the pipe, construction of truck servicing facilities, paving, and so on. These would include noise, dust, fumes and associated problems, but should not disturb the area surrounding Hyperion. The site is far enough from residences and commercial establishments that it should not be noticeable.

One positive impact will be the short term employment of construction workers and the employment of up to 56 new permanent employees for this facility.

3.1.1.11 Irretrievable resources include: opportunity cost, the unusability of sludge trucks and sludge centrifuges for other purposes, the investment of energy in construction or in use of the facilities, and the investment of capital.

Included in the irretrievable impacts would be the consumption of polymers or other chemicals which are not recovered in the treatment process.

3.1.1.12 Included in the short term uses is the savings of money through use of this dewatering equipment as compared to other processing methods.

Long term problems include the high energy cost of using centrifuges for dewatering, as opposed to the lower cost for pumping undewatered sludge elsewhere through a pipeline.

3.1.2 Drying Beds, Sand:

3.1.2.1 Process:

Sand drying beds dry out sludge by solar evaporation and by allowing drainage of moisture through the supporting sand, plus filtration of moisture into soil. The beds of sand are supported by larger diameter crushed rock with drains underneath. The dried sludge is then shoveled or scooped up and placed into trucks for transportation to further processing of for disposal. The filtrate from the drying beds would be returned to the treatment plant headworks or sent elsewhere for other handling. This treatment method works best for digested sludge (secondary sludge) without oil and grease. The bottom of the bed could be sealed to prevent filtrate from seeping into underground water supplies.

The method can dry about 25 pounds per square foot per year of sludge. Thus, about 107 acres would be needed for 160 tons per day, or about 1/6

square mile. If desirable, a buffer zone only 300 feet wide around a drying bed would require a minimum additional area of 68 acres giving a total area of 175 acres or over 1/4 square mile.

3.1.2.2 Subsequent Process:

The solids are transported to their ultimate disposal or to further treatment by truck or other methods. The filtrate can be transported to further processing or disposal. Filtrate characteristics are expected to be similar to those of centrate but with not as high a strength.

IMPACTS

3.1.2.3 Capital cost is between $7 and $14 million for drying beds and the land required for processing 160 tons per day. O&M cost is $1,000,000 to $2,250,000 per year for 160 tons per day.

3.1.2.4 Energy required for pumping, spreading and pick-up of sludge, is not readily quantifiable due to the wide variation in possible site locations and conditions.

3.1.2.5 Air quality problems involve odor problems if stabilized sludge is not used. Insects and possible disease vectors from use of unstabilized sludge may also be a nuisance.

3.1.2.6 Groundwater and surface runoff is possible, especially in the rainy season. This creates a possibility of pollution of surface water and underground water table pollution. The public must kept away from the drying beds because of possible disease hazard.

3.1.2.7 Adjacent land use: Residential or commercial property occupants could suffer through close proximity to sludge drying beds. The problem of nuisances, plus the noise, dust and other factors involved in placing and removing sludge, might create difficulties. See 3.4.1 concerning land availability near Hyperion.

3.1.2.8 Construction impacts would be relatively insignificant except during times of cleaning and reconstructing sludge beds, at which time they would still be relatively minor. If these facilities could be

located an adequate distance from residential or commercial uses, there should be no significant impacts noticed.

3.1.2.9 A relatively small amount of employment would result from this operation. The main employment would be the use of power equipment for the picking up and removal of sludge as well as the spreading of sludge.

3.1.2.10 Opportunity costs would be irretrievable. Materials such as clay pipe, petroleum used for energy, and other commitments of resources, would be relatively irreversible. As a practical matter, any filtration into the water table due to seepage from under the filter bed would be relatively irreversible.

3.1.2.11 Short term uses include an effective means for drying sludge, given enough land. Long term problems include the fact that some topsoil would be gone as a result of preparing drying beds.

FILTERS

3.1.3 Pressure Filters

3.1.3.1 Process:

Sludge would need chemical or thermal conditioning before filtration. Following treatment of the wet sludge with heat or chemicals, the wet sludge is deposited on a cloth frame medium (in a plate frame press for batch treatment, or on a fabric belt for the belt filter press process). The cloth frame medium or belt would retain solids and allow liquids to pass through.

3.1.3.2 One problem with pressure removal of liquids is that the sludge cake tends to stick to the cloth frame medium and requires manual removal.

Chemicals required include addition of from 5% to 25% of lime to wet sludge, or 5% to 7 1/2% ferric chloride, or 100% to 250% ash, to condition the wet sludge. This would become extremely bulky, especially with use of ash.

Pressure filters yield a sludge cake with 10% to 45% total solids depending on the kind of thermal or chemical conditioning, and the type of sludge

being pressed. Capital would be about $4,000,000 for 160 dry tons and O&M cost would be about $1.5 million per year.

3.1.4 Vacuum filters

3.1.4.1 Process:

First, the wet sludge is given chemical or thermal conditioning. Following this, a rotating drum covered with a filter medium dips into the sludge and picks up sludge by vacuum pressure and is then scraped from the filter medium.

3.1.4.3 Problems include "blinding" of the medium, that is, clogging of the filter cloth. This requires a shut-down of the vacuum filter and cleaning of the cloth. This results in high operations and maintenance costs.

3.1.4.4 For conditioning, from 1/2% to 6% of ferric chloride or 2.5% to 20% lime or .25% to 6.25% of polymer, must be added to each ton of wet sludge. The vacuum filter yields a sludge cake with 10% to 40% total solids depending on the conditioning process and the sludge type.

3.1.4.5 Impacts

Capital cost is from $2.5 to $3.4 million dollars to treat 160 dry tons per day. Operations and Maintenance cost is $80,000 to $160,000 per year.

3.1.4.6 Energy costs are not known with pressure filtration. Vacuum filtration has an energy requirement proportional to the surface area of the filter used, but this is not proportional to the solids removed. Energy ranging from about 160 horsepower to 16,000 horsepower is needed for the 160 tons per day. Horsepower per pound of solids is from 1/10 horsepower to 10 horsepower per hour per square foot of filter medium.

3.1.4.7 Impacts on air quality should not be significant if the exhaust of the vacuum pump is cleaned to keep fumes from the filtrate from entering the air. Up to 1/8 million square feet of area would be subject to a vacuum, using the lowest yield process.

3.1.4.8 Land use would be affected depending on the yield of the system. Hyperion vacuum filters could require up to 140,000 square feet of filter cloth

for 160 tons per day. This would require a large number of filter presses, and space to put them in. This is a much larger amount of space than that needed for the centrifuges.

3.1.4.9 Large amounts of chemicals or ash are needed for each ton of sludge, and would add significant amount of bulk to the dewatered project: as much as 70% of the total solids could be ash or chemicals.

3.2 Second Order Dewatering

In certain instances, it may be preferable to further dry the sludge after a dewatering process and before further handling.

The sections below discuss several methods of drying following an initial dewatering process. These processes all need a relatively high solids content of sludge to operate efficiently. None of them appear economical to use with sludge that does not already have most of its moisture removed.

3.2.1 Flash Dryer:

The flash dryer uses a hot stream of gases moving through wet sludge to drive off the water in the wet sludge.

3.2.2 Multiple Hearth Furnace:

The multiple hearth furnace uses a tall furnace with several levels of hearths. The sludge would drop from each level to a lower level until the dried sludge is removed at the bottom.

3.2.3 Rotary Dryer:

The rotary dryer is similar to a front loading clothes dryer, using a tumbling action with hot gases passing through the sludge.

3.2.4 Characteristics of Heat Dryers:

3.2.4.1 Heat drying retains all dissolved and undissolved non-volatile solids in the sludge. All dryers mentioned above require a source of fuel or heat, heavy equipment, special operators, and a high degree of expert maintenance. These methods can dry sludge to as high as 60% dry solids. All heat dryers discussed have a danger of dust explosion.

The above three methods may help to ultimately provide means for sludge disposal, but are relatively expensive, high-energy-cost second-step moisture removers. While of value in long term disposal options, they do not appear suitable for an interim project.

3.2.4.2 Subsequent processes following heat drying include a need to scrub the hot gases to prevent air pollution. The scrubber water would then need some form of treatment. The dry solids should be converted into pellets for easier handling; they are extremely light in weight, loose and fluffy, otherwise.

3.2.4.3 Impacts

Capital costs for heat dryers are estimated at about $4 1/2 million for 160 dry tons per day capacity.

3.2.4.4 Energy for heat dryers would be about 14 1/2 megawatt hours per day, or over 5,000 megawatt hours per year. This would amount to 2,200 million BTU per day or 800,000 million BTU per year. This would require about 2.2 million cubic feet per day

of natural gas or 800 million cubic feet per year of natural gas, enough for 8000 average single family homes in the Los Angeles area. It is unlikely that natural gas would be allotted due to a shortage; other agencies have been denied natural gas for sludge incineration by the State Public Utilities Commission.

It has not been shown that sludge dryers or incinerators of this capacity could meet air pollution control standards in the Los Angeles area.

3.2.4.5 Water quality should be unaffected by this process, since all sludge solids going through heat dryers would be captured by the dry cake or the air scrubbers.

3.2.4.6 Construction impacts from building heat dryers should not be significant on the Hyperion site, unless land outside the existing plant site would be required for location of the dryers.

3.2.4.7 The irreversible and irretrievable impacts would include the sunk costs of equipment, if it is not used for heat drying. In general, this equipment

could not be used for purposes other than sludge drying or some form of incineration. Also irreversible and irretrievable would be any use of fossil fuel.

The benefits from use of this process include moisture reduction for lower transportation cost and ease of disposal. The long term effects would include the depletion of limited natural energy resources.

3.2.5 Belt Dewatering

The following methods for Second Order Dewatering were not considered to be competitive with other methods because they are not common methods. There is no large backlog of technical and theoretical expertise, no great accumulation of operational and maintenance data. Selection of one of these alternatives would be the equivalent of installing a large scale research-and-development project, and does not appear to be an appropriate solution to current Los Angeles City needs. These alternatives are briefly discussed below to include the whole range of possibilities evaluated.

3.2.6 Rotating Gravity Concentrator:

In the rotating gravity concentrator, sludge is tumbled on a high porosity belt moving around drums, until it is dry enough to be removed. In effect, it is like a drying out a ball of dough by rolling it around on a sheet of cloth.

3.2.7 Moving Screen Concentrator

The moving screen concentrator is a high porosity belt on which wet sludge is placed. The belt then moves under a pressure roller which squeezes moisture out of the sludge.

3.2.8 Capillary Dewatering:

The capillary dewatering process consists of a carrier screen with sludge on it and a capillary belt below the screen. The sludge contacts the "capillary action" belt which removes moisture from sludge. The capillary action belt is then dewatered through a pressure roller.

3.2.9 Effectiveness of Above Processes:

Very little hard data is available on the above methods. They are not in common use in Southern California.

3.2.10 Other Second-Order Dewatering:

Basic Extractive Sludge Treatment (B.E.S.T.):

3.2.10.1 This is a proprietary process for extracting moisture from sludge after initial dewatering. First the sludge is mixed with lime or sodium hydroxide. Following this, it is mixed with triethylamine at temperatures below 65°F. It is then centrifuged at 40°F, following which the cake is heated to temperatures of 250° to 325°F. This process yields a cake with about 95° solids, and a density of 16 (sic) pounds per cubic foot. Following this the combustible oils, water and solvents are separated. In the Los Angeles area, much refrigeration would be needed.

3.2.10.2 So far, this is only a pilot project. A system of centrate disposal has not yet been determined. The method of separation for triethylamine, water

and oils needs refinement, as does the method for disposal of the cake. The assumed capital cost is about $2 million, with about 1,200 million BTU per day, or 102 megawatts per day. O&M is assumed to be $3.7 million per year.

3.2.11 Oil Emersion Dehydration: (Carver-Greenfield Process)

In this process, the sludge is mixed with light-weight oil and is then processed through an evaporator. Oil would then be centrifuged out and the oil residue would be steamed out of the remaining cake. This would yield a light fluffy sludge cake with very low moisture content.

There is no data on the disposal of elutriate (water or moisture which has been removed) or of vapor. This process is said to remove all solid solubles into the dry sludge cake.

This project so far is only a pilot method. These costs are based on processing sludge which has been dewatered to a 20% solids content by a First-Order Dewatering Process. Capital cost is assumed to be $1.7 million per year.

3.2.12 The B.E.S.T. and Carver-Greenfield processes appear to be still in the developmental stage. They require further processing of solid residue (pelletizing, for example) and further processing of elutriate before disposal.

3.2.13 The above three methods may help to ultimately provide a means of disposing of sludge, but are relatively expensive second-step moisture removers. They are high in energy required, the B.E.S.T. treatment needs refrigeration as well as heat, and special solvents are needed as well as a large amount of handling. For these reasons the processes are not considered to be adequately refined for use in a full-scale facility.

3.3 Landfill Background Information:

From a regulatory standpoint, California has three basic classifications of landfill types and three groups of refuse. There are two general classifications of landfills which could potentially accept wastewater sludge, Class I and Class II sanitary landfills. Los Angeles City has recommended placing its partially dewatered sludge in a Class I landfill.

3.3.1 Waste Groups:

Group 1 wastes are those embodying toxic and other substances that, if not properly contained, could significantly impair water quality. These wastes may be in either a liquid or solid form. They include, as examples: brines, community incinerator ashes, undewatered sewage sludge, acids, phenols, petroleum fractions, pesticides and chemical containers.

Group 2 wastes are chemically or biologically decomposible materials which are not considered to be environmentally hazardous, as are the Group 1 wastes. Liquid wastes are generally not included in Group 2. Examples of Group 2 wastes include: garbage, rubbish, street sweepings, abandoned vehicles, dead animals, manure, cleaned pesticide containers, and dewatered sewage sludge.

Group 3 wastes are non-water soluble, non-decomposable inert solids. This includes rubber tires, construction and demolition wastes with minor amounts of wood and metals, clay, glass, asbetos, and inert plastics.

3.3.2 Landfill Classes:

Generally speaking, landfills are classed according to the site's ability to provide protection to the surrounding area from migration of the wastes, or their by-products, which are deposited within the fill.

3.3.2.1 Class III:

Class III landfills have the least stringent requirements, as they can only accept Group 3 wastes. Sludge could never be place in Class III landfills. The primary concern is that the waste placed in the sites not be allowed to erode away and cause sedimentation problems elsewhere. These sites could include old pits, quarries or marsh areas.

3.3.2.2 Class II:

Class II disposal sites accept both Group 2 and 3 wastes. These sites may overlie usable groundwater, but they have features which ensure protection of the groundwater. Class II-2 sites may have hydraulic continuity with the groundwater,

but other factors assure protection of the usable groundwater. These factors may include depth to groundwater, artifical barriers, and soil types. Class II-1 sites have either natural or man-made physical features to prevent hydraulic continuity between the site and the groundwater. Class II landfills must also provide protection against a 100-year flood, surface runoff control, and various controls as needed to assure that leachate or gases will not contaminate groundwater. With special Regional Water Quality Control Board approval, certain Group 1 wastes may be allowed in Class II-1 sites.

3.3.2.3 Class I:

All previously mentioned groups of wastes may be deposited in Class I landfills. Class I sites must provide complete protection against hazards to public health and wildlife resources from all wastes deposited for all time, including complete protection of groundwater and surface waters. Numerous soil and geological criteria have been established by the State Water Resources Control Board to ensure longterm safety; additional criteria on flood protection, runoff control, leachate control, and subsurface flow control have also

been established. Because of the extensive amount of soil and geological engineering that goes into developing and evaluating a Class I site, the hazards from natural events such as earthquakes are considered minimal. The classification of "Limited Class I Site" is available to sites which meet all normal requirements except for that of being located outside the 100-year flood zone. A Limited Class I Site may have additional restrictions on types of wastes, how they are handled, and how the site is operated.*

3.3.3 Handling at Sludge Landfills:

3.3.3.1 Liquid Sludge Disposal:

Only Class I landfills are suitable for liquid sludge disposal because they provide positive means of preventing groundwater contamination. Liquid sludge may be piped or delivered by tank truck to the landfill site where it could be

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*Waste Discharge Requirements for Non-Sewerable Waste Disposal to Land, Disposal Site Design and Operation Information; SWRCB; December 7, 1976.

ponded for later incorporation, dumped in an active area of the fill, or disked into the cover soil which is placed over refuse "cells."

3.3.3.1.1 With ponding, sludge is allowed to dry from evaporation or percolation so it will be more manageable when incorporated into the fill. The dried sludge can then easily be disked in and mixed with other wastes. If inadequately digested, ponded sludge could cause odor problems if left to dry for more than a few days prior to incorporation. Ponding would need to be done on an area of landfill property with Class I status, to prevent possible percolation or leachate problems; generally, this would be on top of completed portions of a fill.

3.3.3.1.2 Liquid wastes can be dumped on the active face of fill, thus using the absorptive capacities of other, drier wastes. This practice, while it may get the sludge quickly covered, can cause other problems and usually creates an unsightly operation. (See photo 1). Poor compaction and leachate are probably more likely to occur from this type of operation than would occur from other methods.

Photo 1. Disposal of liquid waste in a Class I landfill.

3.3.3.1.3 A third method of liquid disposal is to thinly spread liquid sludge onto previously covered cells of refuse and then disk it into the cell-covering soil where absorption and evaporation will quickly dry the waste.

3.3.3.1.4 Landfill disposal of liquid sludge has advantages in that it eliminates the need for the large expenditures of capital and operating funds, and the use of energy to dewater the sludge. A disadvantage is that liquid sludge is more difficult to manage than dewatered sludge. Most of its water must be absorbed or evaporated to make the sludge semi-solid and hence more workable with standard landfill machinery. Tank trucking of liquid sludge requires many more trips, using more energy and causing more air emissions and local street congestion than would be used in trucking dewatered sludge. For example, 800 tons of dewatered sludge with 20% solids and 80% water would require 40 twenty-ton truckloads. Liquid sludge with 2-1/2% solids would be 6,400 tons which would require 320 truck trips.

3.3.3.2 Dewatered Sludge Disposal in Landfill:

Dewatered sludge can be disposed of in either Class I or Class II landfills. Handling of sludge in these two landfill classes can be by different methods.

3.3.3.2.1 In a Class I landfill, the operator has more flexibility on how to incorporate dewatered sludge. It could be incorporated directly into the active fill area and mixed with other waste which would absorb the moisture of the sludge cake. Another method is to disk the sludge into the cover material. Disposal of dewatered sludge in a Class II landfill is more restrictive because Class II fills do not have the same inherent protective measures as those of a Class I landfill.

3.3.3.2.2 Dewatered sludge should not normally be mixed directly with the Group 2 wastes (refuse) using the absorption capacity of the refuse, unless the landfill site has a natural or artificial leachate control capability. However, in dry climate areas such as Southern California, direct mixing of the sludge with refuse may be acceptable and may be

Photo 2. Puente Hills Landfill - excavation of cover soil.

Photo 3. Puente Hills Landfill - dumping refuse in active fill area.

approved by the Regional Water Quality Control Board at sites where soil types and depth to groundwater would assure protection of groundwater from leachate and refuse gases.

3.3.3.2.3 As it is uncertain whether or not dewatered sludge mixed with refuse would cause leachate, the LA/OMA Sludge Project is undertaking studies to determine the effects resulting from various ratios of sludge and refuse when placed under the pressures that would be expected in normal landfills. If this study indicates that leachate would not be a problem, direct mixing of dewatered sludge and refuse may become acceptable.

3.3.3.2.4 Another method of disposal of sludge in Class II landfills is to mix the sludge with the cover soil material to reduce moisture content of the mixture to less than 50%. This "sludge-amended soil" may be used as daily cover or as top dressing soil for finished portions of the fill. Such use would not be expected to significantly affect the capacity of the landfill, as it would reduce the amount of imported cover material and would not take up any landfill cell capacity.

3.3.3.2.5 Operationally, the proper placement of dewatered sludge into a Class II landfill is unlikely to have significant impact on water quality, odors, noise levels, seismic hazard, landfill capacity or public health, over and above the impacts of normal refuse handling. Most of the impacts of landfill disposal of dewatered sludge can be expected to result from the specific characteristics of each site.

3.3.4 Site and Route Evaluation:

Generally, the operations of landfills are not expected to have significant changes of impacts if dewatered sludge is added to the normal wastes received. However, there are a number of site-specific factors which, when evaluated, indicate that the sludge disposal may have a greater impact at one landfill site than another. These factors include the nature and extent of development near the site and adjoining the access routes to the site, the overall route taken by the sludge hauling trucks, and the class of landfill. The remaining capacity for the landfill and the time limits of various use permits are factors which affect the duration of use and possibly the social

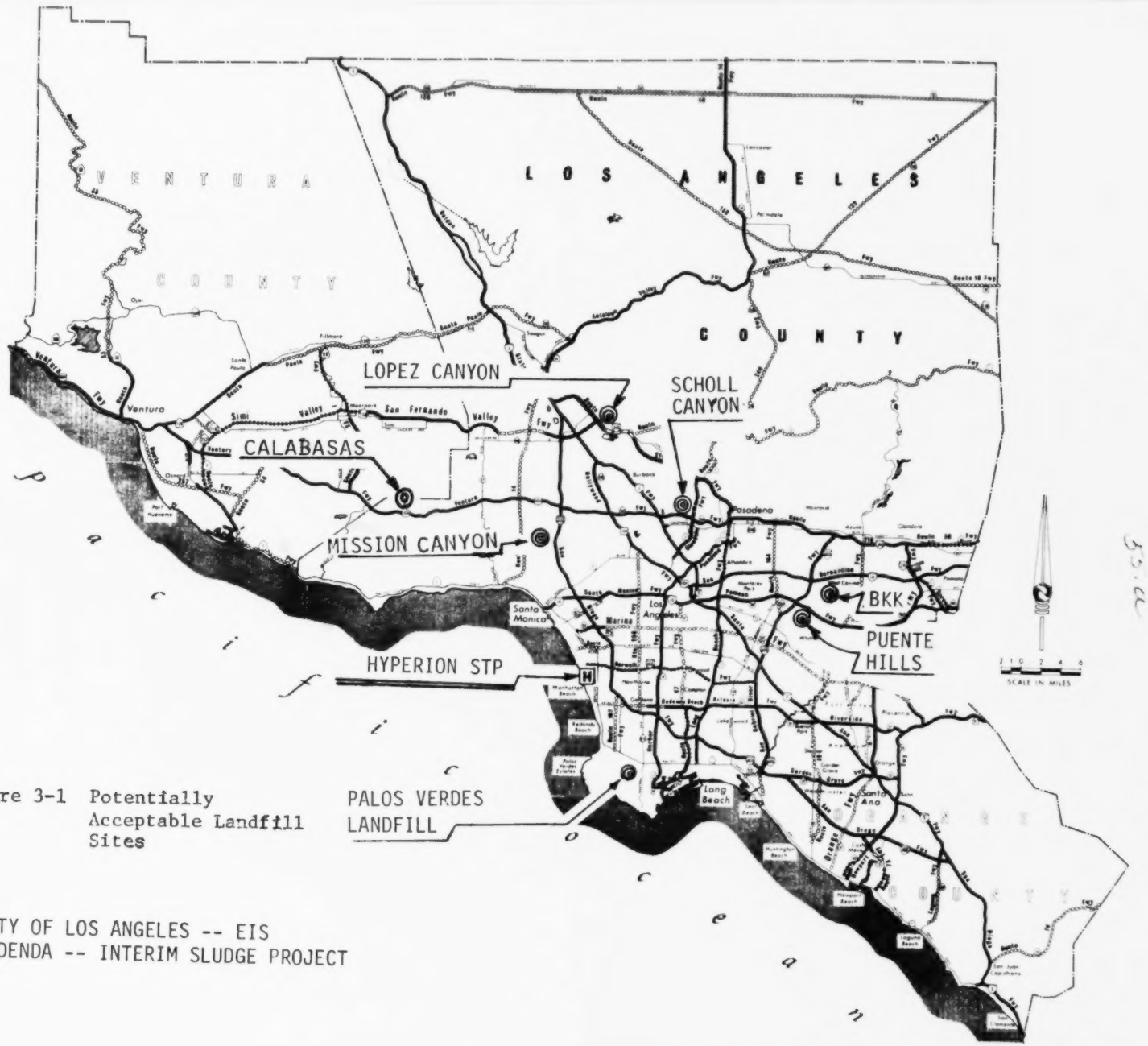

Figure 3-1 Potentially Acceptable Landfill Sites

acceptability of using the particular site; but they are not factors which affect the actual impacts of disposing of sludge at the site.

Site and Route Options:

3.3.4.1 Mission Canyon Landfill:

3.3.4.1.1 Mission Canyon Landfill is within the Los Angeles City Limits between the San Fernando Valley and West Los Angeles, just west of Sepulveda Pass. The site is located in the Santa Monica Mountains, west of the San Diego Freeway and Sepulveda Boulevard, and south of Mulholland Drive. Purchase of this site was financed by the Los Angeles County Board of Supervisors, who also paid for initial improvements, equipment, and access roads. This site was opened in June, 1960 and has been operated by Los Angeles County Sanitation Districts as a Class II landfill under a Conditional Use Permit issued by the City of Los Angeles. The current dump site being used is not actually in Mission Canyon; dumping ceased on that site in spring, 1965, and is currently taking place on nearby property belonging to a golf course owner, the Barclay-Hollander Company.

Photo 4. Mission Canyon Landfill - homes adjacent to completed portions of fill.

Photo 5. Mission Canyon Area - country club under construction next to nearly completed fill area.

3.3.4.1.2 The Los Angeles City Council voted on March 3, 1977, not to renew the use permit for Mission Canyon; it will expire in August, 1977. Mission Canyon Landfill is discussed here because the viability of the area as a landfill site may well be reconsidered. It is considered by some to be the cornerstone of the region's solid waste management plan. Additionally, the continued use of adjacent Barclay-Hollander properties nearby may be an acceptable alternative to reopening Mission Canyon.

3.3.4.1.3 The 480-acre site of Mission Canyon Landfill remaining unfilled was proposed to be expanded to an additional 2550 acres in the Rustic-Sullivan Canyon Area. This would have given the site over 100 years' capacity at the current rate of filling. It has also been proposed in the Los Angeles County Solid Waste Management Plan to seek Class I status for the Mission Canyon Site.

3.3.4.1.4 There are numerous relatively expensive homes which have been built adjacent to the earlier disposal area in Mission Canyon since the filling operation was begun in June 1960. Quite possibly the construction of homes was done in anticipation

Photo 6. Mission Canyon Area. Active fill area viewed from location near country club.

Photo 7. Home with back yard adjoining a completed segment of Mission Canyon landfill.

of the County park to be built upon completion of the fill, since a percentage of the dump fees is set aside for future development of parks atop each of the Los Angeles County Sanitation Districts' landfills. Privately owned recreational facilities have also been developed; the Mountain Gate Country Club, with access on Sepulveda Boulevard, is currently under intensive expansion and development. While the clubhouse and other buildings are on native soil, the golf links themselves are built on recently completed landfill, and the access road follows the alignment of the old refuse truck haul road.

Property owners from these areas are the primary opponents of continued use of the Mission Canyon Landfill. Some say they were promised that landfill operations would not resume, following the cessation in 1965.

3.3.4.1.5 The landfill is operated Monday to Saturday, 8:00 A.M. to 5:00 P.M. and has an average of more than 800 loads of waste brought to the landfill each day. The additional impact of hauling sludge to

Mission Canyon Landfill is about a 6% increase in the total number of loads received, or an increase of about 10% in the number of large trucks.

3.3.4.1.6 Hauling of the dewatered sludge would have a moderately large impact on the landfill operation. Because of its quantity, due in part to its remaining moisture content, dewatered sludge would add about a 25 to 30% increase in the number of tons handled each day. This does not indicate a 25 to 30% increase in landfill space occupied (see the previous discussion concerning "Sludge Amended Soil" in the section on "Dewatered Sludge Disposal in Landfill").

3.3.4.1.7 Haul Route:

The most likely route to be taken by sludge hauling trucks would be to take Imperial Highway east from Hyperion STP to the San Diego Freeway, go north on the Freeway to the Rimerton Road exit, northerly under the Freeway to Sepulveda Boulevard, then north on Sepulveda to the landfill.

3.3.4.1.8 Imperial Highway from Hyperion to the San Diego Freeway, on the boundary of the City of Los Angeles'

Westchester District, the City of El Segundo, and a County of Los Angeles unincorporated area, is a heavily traveled four- to six- lane city street, with raised median and left-turn pockets.

From Hyperion to the Route 405 (San Diego) Freeway, it passes between the Los Angeles International Airport and an industrial area on the north, and an area of mixed commerce and industry on the south. Along the south side of Imperial Highway, Cal Trans has been purchasing and clearing right-of-way for the Route 105 (Norwalk-El Segundo) Freeway. The impacts of trucking along this route segment are not expected to be significant, given the nature of the area and the existing levels of noise, odors and traffic, but the 56 trucks per weekday may result in a noticeable increase of large truck traffic. Traffic volumes vary greatly along this stretch of roadway, with 40,000 vehicles per day near Aviation Boulevard to 16,000 vehicles per day west of Sepulveda Boulevard, and only 5,000 vehicles per day in the vacant area near Hyperion. Traffic in the industrial and manufacturing area near Aviation Boulevard has a high percentage of truck traffic. It is assumed that this route segment would be used on all trucking alternatives

to any landfill, as it is the primary access road from the Hyperion Sewage Treatment Plant (STP) to the nearest freeway.

3.3.4.1.9 San Diego Freeway from Imperial Highway to Rimerton Road: The next route segment to Mission Canyon, 15.3 miles north on the San Diego Freeway, goes past Los Angeles International Airport, Los Angeles City's Westchester District, the City of Inglewood, Culver City, West Los Angeles, Westwood Village, and into Sepulveda Pass in the Santa Monica Mountains. This segment would not be expected to be impacted at all by the trucking of sludge, as numerous heavy trucks pass this area constantly. Of the 205,000 vehicles per day on this section of freeway, about 24,000 are trucks.

3.3.4.1.10 Sepulveda Boulevard near Mission Canyon Landfill: Only a short section of Sepulveda Boulevard, less than a mile, would be involved in traveling from Hyperion to the Mission Canyon landfill. In this area Sepulveda Boulevard has no commercial, residential or industrial uses; it acts as a secondary highway across the mountains which separate the San Fernando Valley from West

Los Angeles City. There would be little or no significant impact from the use of this portion of Sepulveda Boulevard by sludge trucks.

3.3.4.2 Palos Verdes Landfill (Class I):

This landfill is on the northerly side of the Palos Verdes Hills in the Palos Verdes Peninsula area of south Los Angeles County, and is within the boundaries of the City of Rolling Hills Estates, along Crenshaw Boulevard. This site was purchased jointly by Los Angeles County (40%) and Los Angeles County Sanitation Districts (60%) and, as with all Los Angeles County Sanitation Districts (LACSD)-operated landfills, upon completion the site will be turned over to the County for use as a park. The Palos Verdes landfill was opened in 1957 and is now nearing completion. A major part of the completed portion is now the South Coast Botanical Gardens.

3.3.4.2.1 The site is operated as a Class I landfill, in what was previously a deep quarry excavated by the Great Lakes Carbon Company for its diatomaceous earth. The extremely low permeability of the

diatomaceous earth helps ensure that any hazardous materials put into the fill will not migrate either vertically or laterally to where they could cause pollution.

3.3.4.2.2 This landfill has historically received the largest waste volume of any landfill in any County in California, amounting to approximately 1000 loads of refuse each day. It is projected that this site would be completely filled by December 1980 without any placement of sludge, and by as early as October 1980 if sludge placement followed the proposed project schedule. This landfill currently serves the South Bay portion of the County. If Mission Canyon landfill is closed by early 1979 and no other fill sites are available in the immediate vicinity, it is expected that much of the refuse would go to the Palos Verdes landfill. In that instance the Palos Verdes landfill could be completely filled by December 1979 without sludge placement and as early as October 1979 with sludge. Whether Hyperion sludge is placed in this landfill or not, the local communities are faced with the immediate need to locate and develop a new landfill site for the South Bay.

Photo 8. Palos Verdes Landfill - completed portion of fill in foreground. New homes under construction adjacdent to active fill area.

Photo 9. Palos Verdes Landfill. New homes adjacent to fill.

3.3.4.2.3 The surrounding area is largely residential, with new homes still being built on previously undeveloped land. A process of infilling vacant lots in already developed areas is currently taking place, with building sites at a premium and with construction including land quite close to the landfill. The entrance to the landfill is on Crenshaw Boulevard, a street now lined with housing and shopping. The landfill property line directly adjoins single-family residential lots, and landfill operations are within 50 feet of homes. (See photos 8 and 9 showing new houses being constructed adjacent to the landfill.)

3.3.4.2.4 Nearby residents object to the proposed placement of sewage sludge in this landfill, as do officials of several cities and chambers of commerce.

3.3.4.2.5 Palos Verdes landfill does not have freeway access as good as that of most landfills in Los Angeles County. Pacific Coast Highway (State Route 1) is within about one mile of the landfill, as is Hawthorne Boulevard (State Route 107). Both are heavily traveled city streets, as is Crenshaw Boulevard.

Los Angeles City has not yet specified a particular route to be used in the hauling of sludge to Palos Verdes landfill from Hyperion; however, three possible routes were evaluated.

On two routes trucks would travel east on Imperial Highway, then go south on the San Diego Freeway. Trucks on the Hawthorne route would exit at Hawthorne Boulevard and travel south to Pacific Coast Highway, go east for one-half mile, turn south at Crenshaw Boulevard and then enter the landfill, a total length of 15.1 miles including 3.8 miles on Hawthorne.

The Harbor route would follow the San Diego Freeway to the Harbor Freeway, go south on the Harbor Freeway to Pacific Coast Highway, west on Pacific Coast Highway to Crenshaw Boulevard, south on Crenshaw and into the landfill.

The P.C.H. route goes east on Imperial Highway, south on Sepulveda Boulevard (State Route 1) which becomes Pacific Coast Highway, then south on Crenshaw Boulevard to the landfill.

3.3.4.2.6 Hawthorne Boulevard: Hawthorne Boulevard, State Route 107, goes through the City of Lawndale, along the boundary of the City of Redondo Beach,

and through the City of Torrance. It has strip commercial development in Lawndale, and is that city's main street. The South Bay shopping center is a large modern shopping mall in the portion of Redondo Beach adjoining Hawthorne Boulevard, while the City of Torrance has the Old Towne Shopping center, Del Amo shopping Center and Treasury shopping center. This is the major shopping area for many cities in the entire South Bay. It has double left-turn lanes, double right-turn lanes, six to eight through lanes, and the largest amount of traffic congestion in the South Bay area. It is not a desirable route for sludge trucks.

3.3.4.2.7 San Diego and Harbor Freeways: Neither Freeway on the route from Hyperion Treatment Plant to Palos Verdes landfill is expected to be significantly impacted by sludge hauling. The San Diego Freeway around the area of Imperial Highway is congested and can accept little additional traffic except between the hours of 9:00 A.M. and 3:45 P.M.

3.3.4.2.8 Pacific Coast Highway--Harbor to Crenshaw: Pacific Coast Highway (Route 1) between the Route 11 (Harbor) Freeway and the vicinity of the Palos Verdes landfill, goes through the City of Los

Angeles' Harbor City area, through the City of Lomita and into the City of Torrance. The route adjoins the Harbor Lake recreational area and Kaiser Hospital as well as strip commercial development. This is a four lane highway which carries over 3000 cars during the peak traffic hour. Route 1 is the major traffic artery between and parallel to the San Diego Freeway and the Pacific Ocean.

Route 1 from the Harbor Freeway to the point nearest the Palos Verdes landfill is about 3.2 miles; using freeways and a total of 7.5 miles of city streets, the Imperial Highway-San Diego Freeway-Route 1 travel path is 20.5 miles long.

3.3.4.2.9 PCH-Sepulveda: An alternate path of travel from Hyperion to the same point nearest the landfill might use a different portion of State Route 1 (as Sepulveda Boulevard) from Imperial Highway along Route 1 through the cities of El Segundo and Manhattan Beach and through the cities of Hermosa Beach, Redondo Beach and part of the City of Torrance (as Pacific Coast Highway).

This path would involve only about 13 miles of driving, entirely on city streets. The route is lined with older strip commercial development and some new stores, and is the major street for the smaller and older beach towns. The many traffic signals along the route, plus substandard lane widths and the presence of many drivers concerned with shopping or street parking, would result in greater travel time and higher operation and maintenance costs through use of the shorter route. Also, the vehicles would create more annoyance or would be more noticeable along this route.

3.3.4.2.10 Crenshaw Boulevard: Traveling to the Palos Verdes landfill via Imperial Highway-Route 405-Crenshaw Boulevard would involve 9.5 miles of city street and 4.2 miles of freeway, a total of 13.7 miles including 5.9 miles on Crenshaw Boulevard. Travel on Crenshaw would be entirely within the City of Torrance and would go through industrial, redeveloping commercial and new residential land. This route would involve stop-and-go-driving, especially during rush hour. Travel would take longer by this route than by freeway, and impacts would be greater.

3.3.4.2.11 The Harbor route is significantly longer in total mileage than Hawthorne route or P.C.H. at 21.5 miles versus 13, but it minimizes the amount of surface street mileage. Other north-south routes using Crenshaw Boulevard or Western Avenue are probably unacceptable to the affected cities, as much more mileage would be on these local surface streets rather than on State routes; it is noted that the State pays for maintenance cost of State routes, while the local government pays for maintenance costs of the city streets. Also, Crenshaw is a lower capacity road than either Western Avenue or Hawthorne, and use of Western Avenue would require a significantly longer trip than use of Hawthorne Boulevard.

3.3.4.3 Puente Hills Landfill (Class II)

The Puente Hills landfill is located in the eastern portion of Los Angeles County, south of the intersection of the Pomona Freeway with the San Gabriel River Freeway and north of the City of Whittier in the San Gabriel Valley just east of the Whittier Narrows dam. At the base of the hills is the bed of San Jose Creek, a seasonal creek which flows into the seasonal San Gabriel

River. Winter floodwater which flows in these channels is used for groundwater recharge. This site was opened in 1967, has an area of 1,214 acres, a remaining life about 30 years, and will ultimately be used as an element in a recreational greenbelt.

3.3.4.3.1 Puente Hills landfill is operated as a Class II site by County Sanitation Districts of Los Angeles County. It is the third largest landfill in terms of annual tonnage of waste received in Los Angeles County, on the north side of a hill in the Puente Hills Area. The area near the site has not been as subject to residential development as have many other sites in the County; Homes to the north are separated from the landfill by the Pomona Freeway, and to the south the homes are separated from the fill by the intervening hilltops. The site already has gas collection pipes for an energy recovery system, and is currently under study to determine if a positive leachate control system is needed. The most probable route sludge trucks would likely take from Hyperion to Puente Hills is as follows:

3.3.4.3.2 Imperial Highway east to San Diego Freeway, north on the San Diego Freeway to the Santa Monica

Photo 10. Puente Hills Landfill - San Jose Creek at bottom of fill, Pomona Freeway and homes in foreground.

Freeway, east on the Santa Monica Freeway and Pomona Freeway to Peck Road, south on Peck Road to Workman Mill Road, and northerly on Workman Mill Road to the landfill entrance, a distance of 47.1 miles from Hyperion STP.

3.3.4.3.3 Peck Road South from the eastbound Route 60 Freeway, and Workman Mill Road east from Peck Road to the Puente Hills Sanitary Landfill, are relatively wide roads with low traffic volume. This route also serves a local junior college.

3.3.4.4 Scholl Canyon Landfill (Class II)

Scholl Canyon Landfill is at the southern end of the San Rafael Hills at the south east end of the Verdugo Mountains, between the San Gabriel valley to the east and the San Fernando Valley to the west. This landfill, operated by the Sanitation Districts of Los Angeles County and owned by the City of Glendale, is in a corner of Glendale just north of Los Angeles City's Eagle Rock district and just west of Pasadena. Access is from Figueroa Street just north of the Route 134 freeway. This is a large canyon with room for expansion of the

fill operation, in a well-controlled and well-maintained site. This landfill does not have leachate underdrains and controls or a gas migration prevention system.

3.3.4.4.1 There are no residences near the Scholl Canyon landfill site. It is on Figueroa Street north of the Ventura Freeway, about 41 miles from the Hyperion STP. Figueroa Street from the Ventura Freeway to the landfill has only vacant land adjoining it.

The most likely route is Imperial Highway east, San Diego Freeway north, Ventura Freeway east, Figueroa Street north.

3.3.4.5 Lopez Canyon Landfill (Class II)

The Lopez Canyon Landfill is in the City of Los Angeles near its northern boundary in the San Fernando Valley, about a mile east of the City of San Fernando. It lies in the foothills of the San Gabriel Mountains by the mouth of Lopez Canyon, at the northern end of Paxton Street, where it intersects with Lopez Canyon Road north of the Route 210

Freeway. The landfill is presently a small area which would need much expansion work to make it suitable for receiving 800 tons or more of sludge each day. It does not have leachate or gas migration controls.

Currently only Los Angeles City municipal refuse collection trucks use this landfill, to a small extent.

3.3.4.5.1 The most likely route is Imperial Highway east, San Diego Freeway north, Route 118 freeway northeast and Paxton Street northeast to the landfill, a total of 35.2 miles. The Ventura Freeway and San Diego Freeway are both congested in the morning and evening peak traffic periods.

3.3.4.5.2 Paxton Street, Southerly of Glenoaks to the Route 210 Freeway: Paxton street in this area is southerly of and parallel to the Route 118 Freeway; the street is four lanes wide with parking lanes on each side and adjacent single-family houses. Houses on the northerly side are backed up against the freeway slope. Paxton Street carries traffic for the local area as well as LA City trucks bound for the Lopez Canyon Landfill at the intersection

with Lopez Canyon Drive. Traffic is light on this road, which adjoins only vacant land north of Route 210 to the landfill. An increase in the number of refuse trucks might be noticeable, depending on the daily usage of the Lopez Canyon site.

3.3.4.6 Calabasas Landfill (Class I)

The Calabasas landfill is six miles from Ventura County, near the west boundary of Los Angeles County. It lies just north of the Ventura Freeway (Route 101), west of the San Fernando Valley, about 38 miles from the Hyperion Sewage Treatment Plant. Calabasas is located near the community of Agoura and is operated by the County Sanitation Districts of Los Angeles County.

3.3.4.6.1 This 416-acre site is expected to last at least thirty years, according to current County Solid Waste Management Planning Staff*; it currently handles about 375,000 tons of wastes per year. With the addition of sludge, plus normal increase, by 1980 it would be receiving about 675,000 tons per year.

3.3.4.6.2 The site is higher than the surrounding land, and there is no immediately adjacent development. Thus, the landfill does not require a gas migration prevention system, and none has been installed. Although it currently accepts about 35,000 tons per year of liquid wastes, there is no evidence of leaching of liquids through the impervious layers at the bottom of the landfill. No leachate collection system has been installed.

3.3.4.6.3 The site has a leveled ridge for wells which hold all liquid hazardous wastes, with a separate area for solid refuse. Most of the Calabasas site is rated for Class I wastes.

From the Lost Hills Road Exit of the Ventura Freeway to the landfill is approximately one half mile in length. Lost Hills Road is bounded on the left by a residential development of single-family and duplex dwellings, and on the right hand side by a County park. Sludge trucks would be relatively noticeable in this area because of the narrow roadway. Much of the adjacent area is pasture

*Mr. Marvin Sturgeon, LACSD

Photo 11. Calabasas Landfill. Homes in foreground with backyards adjacent to access road.

land which seems to be opening up slowly to residential and commercial development. The landfill area and the immediately surrounding area are currently zoned for agricultural use on three sides, and to the south of the landfill is zoned for low-density residential use.

3.3.4.6.4 The most likely route from Hyperion to Calabasas is east on Imperial Highway, north on the San Diego Freeway, west on the Ventura Freeway and north on Lost Hills Road, a total distance of 4.6 miles of local street and 33.4 miles of freeway, 38.0 miles in all.

3.3.4.7 BKK Landfill (Class I)

This privately owned and operated site is at the west end of the San Jose Hills in the San Gabriel Valley, within the city limits of West Covina. Access is on Azusa Avenue, a heavily traveled four lane divided highway. Capacity is expected to be sufficient for forty years or more of use. Part of this landfill is about 100 feet from a new tract of homes; currently planned earth mounding, road building and a wall should completely block the view of the landfill from these homes.

Photo 12. BKK Landfill. New homes under construction next to fill.

Photo 13. BKK Landfill. New homes under construction across street from landfill.

3.3.4.7.1 The landfill area has a gas migration prevention system which uses negative pressure (a vacuum pump) to collect gases generated by decomposing organic wastes. These gases are then burned in the open air to dispose of them safely. Underdrainage is pumped up and recycled into the top of the landfill.

3.3.4.7.2 The most likely route to BKK is: Imperial Highway east, San Diego Freeway north, Santa Monica Freeway east, Pomona Freeway east and Azusa Avenue north, a total of 56.5 miles.

3.3.4.7.3 Azusa Avenue, From Route 60 north to BKK landfill: From Route 60 north, the street is four lanes wide with left turn pockets and raised median. It is a major artery carrying a maximum load of 2900 vehicles during the peak traffic hour. Uses vary from dairy farms, light industry and small shopping centers to single-family and medium-density multiple residential use, as well as a church with parochial school. This route is already used by refuse trucks; however, the 56 sludge trucks per weekday would be noticed.

3.3.4.7.4 Azusa Avenue, From Route 10 south to BKK:

The route is fronted by a junior high school, single-family dwellings and a church with parochial pre-school. There are more stop lights in this section than in the section south of BKK landfill. Sludge trucks would probably stand out more on this route than on the more southerly portion.

3.3.5 Selection of Best Alternative Landfill Site

Sludge with 80% moisture can currently be deposited directly in Class I landfills only. Assuming use of some option such as mixing sludge with dry soil or refuse, or other means to reduce sludge moisture content, both Class I and Class II sites could be used.

3.3.5 Table 3-1, Comparison of Sanitary Landfills, shows EPA ranking of seven landfill locations, based on capacity, physical and biological impacts, social impacts, energy to transport, economics, water quality, air quality and other impacts.

No attempt has been made to weigh the relative differences in impacts, and no attempt has been made to weigh the relative importance of impacts.

Thus, a ranking of 2 for capacity does not indicate how much less capacity this site has than the Number 1 site; it only shows that site number 2 has less capacity. Since the importance of capacity, of economics, and of other impacts are not judged, the rankings cannot be added to give a meaningful "total score" to each location.

The relative evaluation of different impacts, and the preference of a landfill site, is the prerogative and responsibility of the decision making officials of the City of Los Angeles.

Following the public hearing, and with input from public agencies and private groups and individuals, the City of Los Angeles should reach a decision.

3.3.5.1 Economics of Location Chosen:

Depending on location, handling an average of 800 wet tons a day by mid-1980 would require from 14 trucks, at Palos Verdes, to 28 trucks, at BKK. This is based on the number of round trips which could be made between 8 A.M. and 6 P.M. In addition, spare trucks are needed to allow for "down time"

due to normal maintenance and to repairs needed as a result of off-road use. With the 14 trucks for Palos Verdes, three complete standby units would probably be needed. For the 28 unit fleet traveling to and from BKK, four standby units would be desirable. The extra vehicles would also help handle larger-than-usual stocks of sludge, and would allow for less than full loads.

Trucks of this type, with "flowboy" trailers for trucking sludge, are currently being used by County Sanitation Districts of Los Angeles County. Cost of purchase is about $70,000 each for truck and trailer.

3.3.5.2 Operations and maintenance costs will vary proportionally with distance traveled. Among other considerations, a diesel engine usually can last no longer than 200,000 miles without undergoing major reconstruction. Total fleet miles per year vary from 300,000 miles per year for Palos Verdes to 830,000 miles per year for BKK landfill.

3.3.5.3 Air Quality--Indirect Impacts

It was assumed for purposes of air quality analysis that sludge trucks have a capacity of 20 tons and

are heavy duty diesel-engine vehicles with gross (loaded) road weight of about 77,000 pounds.

The affect of trucks on air quality in the region is assumed to be negligible.

Assuming that in 1980 approximately 160 dry tons of sludge will need trucking, and assuming 80% moisture in the sludge cake, there are 800 tons per day of sludge, or 5600 tons per week. In a five day work week this would require 56 twenty-ton loads on an average weekday. This would require 3,213 miles a day to BKK, the furthest landfill. During this time there are 172 million vehicle miles traveled in the South Coast Air Basin.*

Data on trips to the Palos Verdes landfill and to the BKK landfill were provided to California Department of Transportation for analysis in their latest air quality computer program. Analysis shows that in the worst case, emissions in the South Coast Air Basin would increase less than 0.02% for NO_x and less than 0.002% for reactive hydrocarbons and CO. It is assumed that trips of intermediate length have air quality impacts lying between the two extremes.

*California Department of Transportation

TABLE 3-1 COMPARISON OF SANITARY LANDFILLS

LANDFILL SITE	CAPACITY	PHYSICAL/ BIOLOGICAL IMPACTS	SOCIAL IMPACTS	ENERGY Bbls./yr	ECONOMICS	WATER	SECONDARY AIR IMPACTS			OTHER
							RHC	CO	NOX	
PALOS VERDES	7* Least potential for use	1 project makes little difference	7 most effect at homes, haul routes	2 1,400	2 replace trucks, O&M cost	1 smallest amount to be placed	2	3	1	Local Protest
MISSION CANYON	5 to 20 years	4 with refuse, 8 with sludge alone	3 seen by golfers and home owners	1 1,300	1 least capital, least O&M	4 work needed to prevent leachate	1	1	2	LA City rejected permit app. to continue filling
LOPEZ CANYON	6 small, undeveloped area	7 site development impacts	6 homes along haul route	3 2,000	7 cost of site improvement	6 recharge area for groundwater	3	2	3	capacity to be 100 years when city develops
CALABASAS	2 minimum of 50 years	3 Class I fill: small impact	5 homes along haul route	4 2,100	3 travel cost	3 Assume complete protection: Class I site	4	4	4	
SCHOLL CANYON	4 20 years if permit renewed	6 leachate and gas controls needed	1 no development by site or road	5 2,300	4 travel cost	5 recharge area for groundwater	5	5	5	
PUENTE HILLS	3 over 30 years with permit renewal	5 controls for leachate needed	2 no development near site	6 2,600	5 travel cost	7 recharge area for groundwater	6	6	6	
B.K.K.	1 minimum of 90 years	2 Class I fill: small impact	4 homes, commerce	7 3,300	6 travel cost	2 Assume complete protection: Class I site	7	7	7	

* Ranking system used: 1 = least harmful
7 = most harmful or worst case

8.1.a

MILEAGE AND TRAFFIC VOLUMES FOR ALTERNATE HAUL ROUTES

Street / Cross Street	Distance (miles)	Peak Hour* Traffic Volume	Peak ** Month ADT	Capacity
Hawthorne Bl				
San Diego Fwy	5.5	4400	48,000	full
Pacific Coast Hwy	1.4	est. 3600	36,000	small capacity occasionally
Palos Verdes Dr. N.				
Pacific Coast Hwy				
Imperial Hwy	9.9	3950	39,500	small capacity available wkdays
Hawthorne Bl	1.25	2500	33,000	"
Crenshaw Bl	3.15	3100	41,000	
Harbor Fwy				
Palos Verdes Dr. N.				
Hawthorne	0.5	1897	23,168	
Crenshaw				
Western Av				
San Diego Fwy	4.5	1700	23,300	
Pacific Coast Hwy				

Street / Cross Street	Distance (miles)	Peak Hour* Traffic Volume	Peak ** Month ADT	Capacity
San Diego Fwy				
118 Fwy	7.9	12,800	158,000	off-peak & northbound all day is passable; southbound peak heavily congested.
Ventura Fwy	3.9	13,200	170,000	
Rimerton Rd	6.4	14,500	205,000	
Santa Monica Fwy	8.9	15,500	230,000	
Imperial Hwy	3.62	14,900	208,000	off-peak OK
Hawthorne	2.15	14,900	179,000	on-peak impossible Peak 6:30-9AM 3:45PM-6:30PM
Crenshaw	1.15	14,600	176,000	same as above
Western	1.14	14,800	184,000	
Harbor Fwy				
Harbor Fwy				
San Diego Fwy	4.7	900	116,000	southbound OK in AM, northbound OK in PM; otherwise same as above
Pacific Coast Hwy				

Street	Cross Street	Distance (miles)	Peak Hour* Traffic Volume	Peak ** Month ADT	Capacity
Imperial Hwy					
	Hyperion	3.0	3900	40,000	congested westbound in AM, Eastbound in PM
	Sepulveda	2.25	2115	20,200	
	San Diego Fwy				

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* 30th highest hourly traffic volume of the year measured in both directions (2 way traffic)

** ADT = average daily traffic

TABLE 3-2

Fuel consumption, mid-1980's

Destination	Street miles/day	Freeway miles/day	Street gal's Fuel at 3.0 mpg	Freeway gal's Fuel at 5.5 mpg	Total Fuel/day (gal)	Bbl/yr
Palos Verdes	420	728	140	132	272	1700
Mission Hills	241	913	80	166	246	1300
Lopez Canyon	246	1725	82	313	395	2000
Scholl Canyon	241	2066	80	376	456	2300
Puente Hills	297	2341	99	425	524	2600
BKK	414	2789	138	507	645	3300
Calabasas	230	1898	76	345	421	2100

Based on 3 mpg city, 5.5 mpg highway, heavy duty diesel engines of newest "fuel squeezer" design.

Data Source: California Department of Transportation Research Unit. Assume 77,000 lb vehicle with 20-ton payload.

TABLE 3-3 EMISSION FACTORS (1976)

Destination	Trip Length (miles)	Average Speed (MPH)	COMPOSITE EMISSION FACTOR (GRAMS/MILE) Reactive Hydrocarbons	CO	NOX
Palos Verdes	20.5	25	4.03	19.39	23.20
BKK	57.1	35	3.27	12.54	25.42

Total weekday Emissions in tons per day (1979) assuming 56 truck trips per day

Destination	Reactive Hydrocarbons	CO	NOX
Palos Verdes	.01	.05	.06
BKK	.02	.09	.18
Air Basin Total (1973)	1,510	7,530	1.220

Source: A.R.B.

Sources: California Department of Transportation computer analysis
EMFAC3 PROGRAM based on August 1976 Motor Vehicle Emission
Factors for Estimates of Highway Impact on Air Quality
State Air Resources Board 1973 South Coast Air Basin measurements

Alternatives and Impacts:

3.4 Non-Landfill Disposal Options:

Non-landfill disposal options involve those methods of sludge use, destruction or disposal other than burying in a regular sanitary landfill.

3.4.1 Land Application Near Hyperion STP:

In general, alternatives which involve placement of sludge on landfills near Hyperion (for composting, drying beds, soil enrichment or similar uses) cannot include use of land near Hyperion STP without significant environmental or social consequences. One possible exception could involve the Baldwin Hills oil field.

3.4.1.1 Rare and Endangered Species:

On the west end of Los Angeles International Airport, north of Hyperion, and on land south of Hyperion, are remnants of the El Segundo dune system which provides the habitat for a rare and endangered species. The El Segundo Blue butterfly

(Shijimiaeoides battoides allyni) lives only in the El Segundo dunes and feeds only on its host plant, Eriogonum parvifolium. It is prohibited to take or disturb or endanger the butterfly or its environment in the El Segundo dunes area.

3.4.1.2 Airport Operations:

Land application of sludge often attracts birds in great numbers. Application of sludge west of Los Angeles International Airport, or in the Ballona Creek area west of Hughes Airport, would cause potential hazards to airport operations.

3.4.1.3 Zoning Ordinances and Other Laws:

There is little open space within 25 miles of Hyperion Sewage Treatment Plant where land application of sludge could be performed; the Los Angeles Metropolitan Area is well known for its urban sprawl, which fuses over a hundred cities together in one continuous megalopolis. All of these municipalities and the unincorporated areas have zoning ordinances, and other laws regulating public nuisances and health hazards, which prevent certain land uses near residences or commerce, or even

prohibit certain uses entirely within municipal limits. One such example is the gradual migration of dairy herds out of the Los Angeles area; more and more cities determined that such an odorous land use was not acceptable within City limits, so Los Angeles County has been losing its dairy industry. There is little land near Hyperion where land application of sludge would not break local ordinances, and cause more nuisance than herds of dairy cattle.

3.4.1.4 Open land near Hyperion is mainly in hilly areas such as the Santa Monica Mountains or Baldwin Hills, places where the land has been too steep for large scale construction or for agriculture. Composting or other land application would remove surface vegetation and break the soil crust, allowing large scale erosion and landslides when the Santa Ana winds or the seasonal heavy rains arrive. Also, land application would stimulate growth of vegetation, requiring constant removal of brush to control fire hazards. In the dry Los Angeles summer, areas on the outskirts of the City or in the hills are constantly in danger of brushborne fire; sludge application programs in areas like

the Baldwin Hills Oil Field would require a sub-program for fire prevention maintenance.

3.4.1.5 Odor:

Sludge is occasionally very odorous, and thus its disposal or processing site is of public concern. The Baldwin Hills or Santa Monica Mountains topography might aid in the dissipation of odors over a larger area due to the high site elevations and exposure to winds.

3.4.1.6 Baldwin Hills:

Los Angeles County is in the process of condemning land for a 1300-acre regional park in the Baldwin Hills oil field area, now owned by several oil companies. This land is, in general, quite bare due to efforts to keep down brush and prevent fire hazards. The first 400 acres of the proposed park should be ready for development by mid-1978, and the balance of the 1300 acres would be purchased over the next five to ten years.

3.4.1.7 It is possible that this area could use sludge or soil enrichment, if not in the initial 400 acre

parcel then in the remainder, to aid in the development of the park. This is one possibility for joint land use planning and interagency coordination. It is doubtful that this could be a viable short-term solution without active participation and coordination by the City staff, due to the planning and acquisition problems inherent in a multiple-agency project.

3.4.2 Dedicated Lands:

Dedicated lands are lands permanently dedicated to sludge disposal only, or with restrictions on future land use. Sludge could be applied in high intensity amounts of 1000 to 2000 dry tons total per acre, accumulated during the life of the project. This would require the purchase of 40 to 80 acres per year of additional land, or up to one square mile in eight years.

3.4.2.1 1000 to 2000 dry tons per acre is far less material than it would be possible to place in a sanitary landfill, since it involves a final total of only 46 dry pounds per square foot for the sludge.

3.4.2.2 Impacts: See the section on Soil Conditioner for impacts. There could be leachate of materials into the groundwater, which would affect water quality. Also, this landfill area would keep growing in size, leaving a fallow area.

3.4.3 Deep Ocean Disposal:

Release in deep water below 1000 meters after sludge digestion has been suggested as acceptable if the material would stay in place and not be spread by undersea currents. Proponents of this disposal method have stated that it would be best to place this material below the Continental Shelf or in a deep pit, below the area of aerobic activity. This would require placing of large pipes far below where any outfall has yet been placed, or lowering of the sludge from ships. At present, the deepest any sewage outfall has been placed is about 300 feet below the surface, versus a Cal Tech student proposal to place an outfall extending to 3,000 feet deep and 15 miles from shore.

3.4.3.1 Water Quality Impacts: The impacts of the deep water discharge would include, firstly, impacts of

the techniques needed to get a pipe in place or to have a ship lower material 3000 feet. It would also mean the placing of potentially toxic metals and chlorinated hydrocarbons where they might be biologically concentrated in a food chain, resulting in future harmful effects on people or other species.

3.4.3.2 While little is known of the ecology of the deep ocean basins it is likely that, with the scarcity of life currently existing in these basins, the addition of sludge with its numerous toxicants could adversely affect a deep basin's ecology.

Apparently all deep basins are subject to periodic upwellings which bring up huge volumes of cold, nutrient-rich deep ocean water, and which are a major nutrient source for local fisheries. Some basins have seasonal upwellings, and some have upwelling periods in the tens of even hundreds of years. The impact of a basin upwelling after having received sludge for 10, 20, 50 or 100 years is unknown; it could conceivably have serious adverse environmental consequences, with many years discharge of toxic substances suddenly swept into the environment of coastal marine life.

3.4.3.3 The facilities construction impacts would include the necessity for barges, ships, piping, storage, or pier construction, plus the impacts of operating vehicles or transportation systems.

3.4.3.4 Because of major unknown factors and the need for further study, as well as the extreme costs of deep ocean construction or shipping purchase, this project is not suitable for an interim project.

3.4.3.5. Moreover, Federal and State policies and regulations would prohibit consideration of this alternative, and also prohibit consideration of continuing the existing practice of disposal through the Seven Mile Outfall.

3.4.4 Export:

Export is defined as shipping sludge from the immediate area without control of its use. In effect, this could be considered either as shipping Hyperion's problems away or shipping our resources away. This would involve placing sludge into trucks, pipes, rail tank cars or ships for use elsewhere as a soil conditioner, a source of compost, fertilizer, or whatever. If use was

elsewhere in the United States or if shipping affected the United States, this would involve further consideration by the Environmental Protection Agency.

Impacts:

3.4.4.1 Costs: Depending on a transportation method chosen, cost would be $1 million or more for the capital investment needed. Operations and maintenance cost varies greatly with the method chosen.

3.4.4.2 Air quality controls are needed for odor control during transport, and to control the build-up of toxic or explosive gases.

3.4.4.3 Water quality should not be affected by export, except by accident, depending on use at the end-point of delivery.

3.4.4.4 Energy: Road transportation is a high energy method of shipping. Other modes involve storage for exports in economical size batches, with construction impacts for pipe, rail shipments or other modes.

3.4.4.5 A transportation system for sludge might be usable for the LA/OMA Project or for transporting other substances. Rails, pipes or roadbeds are semi-permanent facilities, and are likely to remain in place permanently unless the land is needed for something else. If the transportation facility is not to be used in the future, due to the transient nature of this project, the cost of rail, pipe, or road vehicles would be lost.

3.4.4.6 The irreversible and irretrievable impacts associated with the project would be the sunk cost of ships, rail cars, roads, etc., and the associated impacts of construction. As mentioned previously, these facilities are semi-permanent in nature.

3.4.5. Soil Conditioner (non-Composted):

3.4.5.1 Sludge humus could be used to improve soil moisture retentiveness for agricultural lands. Wet sludge could act as a good fertilizer for land, if adequate nutrients were in the sludge. In the usual case, where there are not high enough levels of nitrates or phosphates for a good fertilizer, the

sludge can be used as a conditioner. The sludge would need transport and spreading, and its use would be limited to areas where sludge is competitive with other fertilizers or conditioners, and to certain types of crops. For purposes such as use in forestry, or in a wildlife refuge, there would be different requirements for the characteristics of the sludge.

3.4.5.2 The cost of transportation of sludge by truck, pipeline or train, with its associated O&M cost, would depend on the location of the land. The spreading cost would depend on the nature of the soil use and what crops were to be used.

3.4.5.3 Energy would be used for transportation and spreading of the sludge.

3.4.5.4 Air quality problems would include odor.

3.4.5.5. Health problems would include the pests and disease vectors that might be associated with sludge. There would be a need to keep people or food animals away from the wet sludge. There is also concern that the trace amounts of metals and chemicals in Sludge may accumulate in the soil or in plant

tissues, to dangerous levels. Research is being undertaken by the LA/OMA Sludge Project to evaluate these concerns.

3.4.5.6. To prevent water quality problems arising from leachate entering the water table and contaminating drinking water, sites would require careful hydrological and geological evaluation before selection for use with sludge conditioner.

3.4.5.7 The quality of land required and the possible future use of land treated with sludge would be dependent on the optimum amount of soil conditioner applied per acre and what the ecosystem impacts on the land would be. Sandy soils such as desert soils could use huge amounts of conditioner, and clay soils would need much less. Also, there are heavy metals limitations to consider. It is possible that land used for sludge soil conditioning would not be usuable for food crops for a year or more after sludge application ceased, depending on the amount applied.

3.4.5.8 Once the soil conditioner has been spread, soaked-in sludge chemicals are difficult or impossible to remove. In general, cost for the sludge transport

and spreading system would probably not be recoverable, as this would be specialized equipment.

3.4.5.9 Soil treated with sludge may be premanently restricted from growing leafy vegetables and possibly other crops after sludge application. Against this, there is a possibility of having a soil conditioner which is priced cheaper than the normal commercial soil additives.

3.4.5.10 Soil conditioner does not appear to be a suitable method for interim disposal. It could take several years to locate, evaluate and acquire suitable land, and to develop transporation and spreading systems. Systems for transporting wet sludge could be extremely expensive. This alternative would best be evaluated and planned by LA/OMA in a multi-agency planning context.

3.4.6 Incorporation into Commercial Fertilizers:

With the addition of nitrate and with pathogen reduction, the use of sludge is acceptable as a fertilizer for non-food chain uses only.

3.4.7 Composting:

3.4.7.1 Process: This is a process to stabilize sludge and dry it, using the heat of the natural processes. Sludge is mixed with dry organic material and is exposed to air, usually in piles or windrows. Composting requires nitrogen, oxygen and organic material. The process is speeded by aeration, admixture of dry organic material (already composted sludge is one possible material), and reduction of heat loss. Short detention time requires very high (4:1) ratios of dry material to sludge.

3.4.7.2 Composting can be done using City employees for all work needed including: trucking sludge away from Hyperion Treatment Plant to the composting site, removing sludge from trucks, spreading sludge, purchasing and mixing of organic materials with sludge, turning compost piles, and so on. There are disadvantages to using City employees since this requires more employees than needed to just sell sludge to a contractor. On the other hand, if a City composting operation takes place, there is greater assurance that only properly matured compost from stabilized sludge is released to market. Therefore, City composting is recommended.

3.4.7.3 Marketing of the matured compost would involve sacking, storage, distribution and sales to individual consumers. Rather than using City staff in a competitive business venture, it appears that a more desirable alternative would be to sell the entire output of compost at competitive bid. This course of action may make it possible to avoid City capital and labor costs for bagging, trucking, and storage equipment and facilities.

Impacts:

3.4.7.4 Capital cost of composting may include purchase of land. In semi-residential areas or areas which may become residential in the near term, costs are $20,000 per acre and more, while industrial land is selling as high as $175,000 per acre or renting for over $15,000 per acre per year. There is no land within several miles of Hyperion where large-scale composting would be allowed due to zoning, unless a special use permit were issued. Also, environmental and nuisance factors prevent composting too close to residences.

O&M cost would be about $1000 per day for spreading sludge and turning the soil.

3.4.7.5 Energy cost for spreading and turning would be about 8 megawatts per day.

3.4.7.6 Impacts on local air quality could be small to moderate, with odor, dust, mud or insect infestation being involved.

3.4.7.7 Possible hazards to health could exist from using improperly stabilized sludge in the compost, if care is not taken to ensure full composting. Sludge compost should be used for turf and other ornamental purposes rather than for vegetable gardens, to avoid contamination of food by microorganisms, heavy metals or chemicals which may be in sludge.

3.4.7.8 There do not appear to be significant irreversible or irretrievable impacts or commitments of resources from composting.

3.4.7.9 Short term uses include the fact that properly used compost is a good way to dispose of sludge. One benefit is the saving of nutrients and soil conditioning materials.

3.4.7.10 In the long term, use of land for composting could lead to a renewal of soil minerals and improving the land for agriculture. This depends to a great extent on the quality of the sludge.

3.4.7.11 Composting is not an alternative which could be quickly implemented. Time-consuming actions include the processes of locating and acquiring suitable land, the need for an environmental document evaluating composting at the chosen site, construction of special equipment, and the need to negotiate marketing agreements. Los Angeles County and Orange County sludge compost now being marketed could also make it difficult for Hyperion sludge to compete in the short term.

3.4.8 Piping to Desert:

See the section on "Soil Conditioner." Basically, impacts of that option are similar to piping material to the desert, with the exceptions that the desert has a greater ecosystem fragility and the desert is further than most nearby areas where the material could be used for farming. Breaking the soil crust in the desert, to "plough under" the materials, could have long-term effects on

flora and fauna, and could cause replacement of native species with intrusive imports. This could also leave a barrier to floral/faunal/pollen migration and could affect Rare & Endangered species. It would also leave a scarred area of high nutrient content. A possible benefit of this project is that part of the desert could thus become a future agricultural area, given an available water source. As in the case of soil conditioner, time constraint prevents use of this alternative for an interim project.

3.4.8.1. Health: Health considerations include a need to protect casual visitors from contamination with the sludge. To do this would require fencing or signposting.

3.4.8.2 In cases of a high water table, only a small dosage of sludge per acre would be allowed, to control water pollution. this would require an enormous area of land in use to protect the water under the desert from pollution.

3.4.9 Sludge Use with Re-Forestation and Range Improvements

Use of sludge with re-forestation is possible for a limited use on minor projects. The spreading of

sludge material in the forest, with its moisture and nourishment, could lead to increased undergrowth with a concomitant increase in fire hazards. There is also the possibility of water pollution. A low-solids sludge would be used for its moisture content, which would result in a large need for transportation facilities. This in turn could have negative effects on a forest. The project would need 13 square miles to 60 square miles of land to take care of the Hyperion sludge, and this much forest or range is not available for such use near Hyperion. The public and grazing animals would have to stay away during applications and for some time afterwards. Much research would be needed before allowing spreading on desert range.

3.4.10 Pyrolysis:

Pyrolysis includes a breaking down of substances with heat, but without combustion.

In this system, heat would be applied from an externally fueled source in a low-oxygen or no-oxygen atmosphere, resulting in the sludge breaking down into combustible gases and solids plus inert

material. This is similar to the 'coking' process involved in converting wood to charcoal. A furnace or kiln or a 'fluidized bed reactor' would be used. The fluidized bed is a specialized furnace-like system using a hot sand bed or similar medium to heat materials.

3.4.10.1 For autogenic pyrolysis, (self-sustaining pyrolysis without an external fuel source) sludge with a very high solids content is needed. Generally an external fuel source would be used, rather than autogenic pyrolysis, since partially dry sludge requires more energy to be dried and heated to combustion than can be produced from burning sludge.

3.4.10.2 Sludge would have to be more than 30% solids for autogenic pyrolysis, which is difficult to achieve without high-energy treatment prior to the pyrolysis process. Also, a scrubber is required for excess gases.

Impacts:

3.4.10.3 See the discussion of impacts under Section 1, Dewatering Processes, for heat dryers. Also, the air quality impacts of burning pyrolysis-derived

fuel must be considered. In general, this is not a clean fuel and would require scrubbing. Capital cost for pyrolysis units or incinerators is about $11 million for 160 dry tons, and O&M cost would be about $2 million, primarily for fuel.

3.4.10.4 There could be ash disposal problems. A Class I landfill would probably be required. The char produced by pyrolysis would be combustible.

3.4.10.5 Gross energy requirements are higher for pyrolysis than for drying of sludge. Also, the pyrolysis gases would need to be used for fuel immediately, before cooling down; they cannot be easily gathered and stored.

3.4.11 Incineration:

Incineration is similar to pyrolysis, but with enough oxygen available for complete combustion. It requires less energy input because it would approach closer to autogenic (self sustaining) combustion. That is, the char would burn and add heat to the process.

3.4.11.1 Impacts:

Impacts of incineration are similar to those of pyrolysis, except that the solid residue would not be partly combustible. Problems involving possible leaching out of heavy metals or other substances from the ash need be considered if Class II landfills are used. There are laws regulating incinerators in Los Angeles City and other AQMD areas due to problems in air quality maintenance areas, if sludge would be burned by the municipality. Rubbish cannot be burned in the Los Angeles Air Quality Maintenance District without an AQMD permit.

3.4.12 Wet Oxidation:

(This is the "Barber-Coleman" process.) This is an undeveloped system which would use high temperatures in closed pressure chambers to stimulate oxidation. The process has been abandoned by the potential manufacturer due to unreliability of the process and equipment failures as well as high cost. Chamber corrosion was one of several problems.

Chapter Four: Ocean Disposal of Hyperion Sludge ("No Project" Alternative)

4.0 Ocean disposal of Hyperion sludge through the Seven Mile Outfall has been practiced since 1957. This practice is therefore the "No Project" alternative. As previously mentioned, it is not viable as it would violate Federal and State permits and regulations.

After the first few years of discharge of sludge, little study of the effects was performed. Work done by the Southern California Coastal Water Research Project greatly increased the available information regarding the discharge, but still does little to answer the question as to what ultimately happens to the vast bulk of material discharged. Oceanographic information is difficult and expensive to obtain. The resulting limited information leads to unresolved data conflicts and sometimes opposing interpretations of the limited data.

4.1 Physical Conditions and Impacts

4.1.1 Hyperion Sludge Characteristics

4.1.1.1 The sludge mixture which is discharged from the Hyperion Sewage Treatment Plant contains about 3/4% solids. The volume discharged is about 4.8 million gallons per day, of which 1.3 million gallons per day is screened and digested primary treatment sludge, 1.0 million gallons per day is waste activated sludge, and 2.5 million gallons per day is secondary treated effluent. While the discharge is mostly water, the solids volume discharged is about 300,000 cubic meters per year.

4.1.1.2 Large amounts of oil and grease, cadmium, chromium, zinc, and other metals as well as smaller quantities of highly toxic chlorinated hydrocarbons and mercury are discharged through the outfall. Table 4-1 lists concentrations and mass emissions of constituents monitored in the sludge discharge over the last six years. Table 4-2 compares the mass emissions resulting from the sludge discharge from Hyperion effluent and the total from the five major dischargers in Southern California. The relative mass emissions of the total Hyperion

HYPERION SEVEN-MILE SLUDGE CONCENTRATIONS AND MASS EMISSION RATES

	1971		1972		1973		1974		1975		1975		
	Concentration	Mass Emission Rate	Concentration	Mass Emission Rate	Concentration	Mass Emission Rate	Concentration	Mass Emission Rate	Concentration	Mass Emission Rate	Concentration	Mass Emission Rate	Total
FLOW	Per Day	Per Year	Per Day	Per Year	Per Day	Per Year	Per Day	Per Year	Per Day	Per Year	Per Day	Per Year	
Million gallons	4.62	1,759	4.6	1,679	4.8	1,752	4.7	1,716	4.3	1,570	4.1	1,497	9,973 x 10^6 gal.
Liters	18.2 x 10^5	6.66 x 10^9	17.4 x 10^6	6.36 x 10^9	18.2 x 10^6	6.63 x 10^9	17.8 x 10^6	6.49 x 10^9	16.3 x 10^6	5.94 x 10^9	15.5 x 10^6	5.66 x 10^9	37.7 x 10^9 liters
GENERAL CONSTITUENTS	mg/liter	metric tons/year	mg/liter	metric tons/year	mg/liter	metric tons/year	mg/liter	metric tons/year	mg/liter	metric tons/year	mg/liter	metric tons/year	metric tons*
Total solids	7,500	49,900	8,000	54,700	7,500	49,900	7,300	47,400	10,300	61,100	9,900	55,000	319,000
BOD	–	–	–	–	–	–	1,900	12,300	–	–	–	–	–
Oil & grease	922	6,130	636	4,045	922	6,130	900	5,840	970	5,761	679	3,840	31,750
Total phosphate	–	–	–	–	–	–	–	–	80	475	141	793	–
Cyanide	0.11	0.73	0.10	0.636	0.11	0.73	0.53	3.44	0.67	3.98	0.44	2.5	12.02
Phenols	–	–	–	–	–	–	–	–	0.29	1.72	0.61	3.46	–
TRACE METALS													
METALS	mg/liter	metric tons/year	mg/liter	metric tons/year	mg/liter	metric tons/year	mg/liter	metric tons/year	mg/liter	metric tons/year	mg/liter	metric tons/year	metric tons*
Silver	0.03	0.20	0.219	1.90	0.60	5.32	0.40	2.60	0.80	4.75	0.66	4.63	19.6
Arsenic	0.08	0.54	0.03	0.19	0.27	1.80	0.18	1.17	0.29	1.72	0.23	1.59	7.0
Cadmium	0.23	1.53	0.42	2.67	0.93	6.52	1.27	8.24	1.17	6.95	1.31	7.44	33.4
Chromium	2.1	14.0	8.73	52.3	18.2	121.0	15.1	98.0	11.7	69.5	11.66	66.0	421.0
Copper	12.2	81.3	7.53	48.2	13.6	90.2	13.9	90.2	16.8	99.8	16.80	95.1	505.0
Mercury	0.10	0.666	0.125	0.80	0.14	0.93	0.15	0.97	0.108	0.642	0.098	0.555	4.6
Nickel	2.6	17.3	2.04	13.0	3.57	23.7	3.1	20.1	3.1	18.4	3.69	20.4	113.0
Lead	0.51	3.40	1.69	11.4	1.57	10.4	1.13	7.33	2.05	12.2	1.65	9.34	54.2
Selenium	0.056	0.37	0.25	1.59	0.45	12.99	0.40	2.60	0.27	1.60	1.16	6.57	15.0
Zinc	16.5	110.0	10.74	69.3	27.0	180.0	23.9	155.0	23.1	137.2	21.10	119.4	770.0
CHLORINATED HYDROCARBONS	µg/liter	kg/year	µg/liter	kg/year	µg/liter	kg/year	µg/liter	kg/year	µg/liter	kg/year	µg/liter	kg/year	kilograms
Hyperion Data													
Total DDT	2.07	13.8	6.75	42.9	4.03	26.8	2.59	16.9	6.94	41.2	7.09	40.2	182
Total PCB	28.7	191.0	92.0	590	25.4	169	3.30	21.4	17.3	103	7.66	43.4	1,118
SCCWRP Data**													
Total DDT	ND	ND	5	31.8	1.4	9.3	2.6	16.9	2.8	16.6	3.2	18.1	82.7
Total PCB	ND	ND	280	1,780	26.0	172	122	792	40.2	239	20.9	118	3,101

*Dry Weight.

**SCCWRP 1971-75 data from Final Report to EPA, Grants R801153 and R80307; SCCWRP 1976 data to be published in 1977 Annual Report.

Table 4-1

Reproduced from best available copy.

discharge compared to the total of the five sewage discharges are also presented, to give an indication of impacts the sludge discharge could have if Hyperion were upgraded to full secondary and the Seven Mile Outfall sludge discharge were continued with the addition of more secondary treatment sludge.

4.1.1.3 Effective means to decrease the amounts of toxic metals and other trace substances may be possible, depending on the sources of these contaminants. Contaminants from household substances and trace metals disolving from plumbing in millions of homes would be almost impossible to control, while industrial discharges could be significantly reduced by a stringent and aggressively enforced Industrial Source Control Program.

Los Angeles City currently has an Industrial Source Control Program which was meant to reduce contaminants from industry. However, this program depends on voluntary self-enforcement and does not appear to have significantly affected discharge quantities. Therefore, an effective enforcement of the City's present program might cause significant reduction in industrial discharges. Depending on where the greater portion of the toxicants come from, a large reduction in industrial contaminants might greatly reduce total contaminants.

TABLE 4-2

Mass Emissions - Hyperion & 5 Major So. California Dischargers - 1975

Constituents	LA City Effluent	LA City Sludge	Total of 5 So. Calif. Dischargers	% Sludge is of Total	% LA is of Total
Flow mgd	345	4.3	985	0.4	35.5
metric ton/yr					
TSS	40,460	69,720	295,448	23.6	37.3
Oil & Grease	9,532	6,566	58,222	11.3	27.6
Cyanide*	66.7	4.5	(226+)*	(2.0)	(31.5)
Phenols	19.1	2	2117	0.1	1.0
Silver	9.5	5.4	26.3	20.5	56.7
Arsenic	4.8	2	12.2	16.4	55.7
Cadmium	9.5	7.9	52	15.2	33.5
Chromium	62	79.2	587.6	13.4	23.9
Copper	91	113.7	525	21.7	39.0
Mercury	0.95	0.73	2.33	31.3	72.1
Nickel	71	21	287	7.3	32.1
Lead*	14.2	13.9	(200)	(7.0)	(14.1)
Zinc	110	156	1156	13.5	23.0
Kg/yr					
Total DDT	777	43.9	1994	2.2	41.2
Total PCB	1868	117.1	6025	1.9	32.9

Data from: SCCWRP Annual Report, 1976.
SCCWRP Annual Report 1977 was not available at time of printing.

*Numbers in parenthesis are estimates made where data is incomplete for all 5 plants.

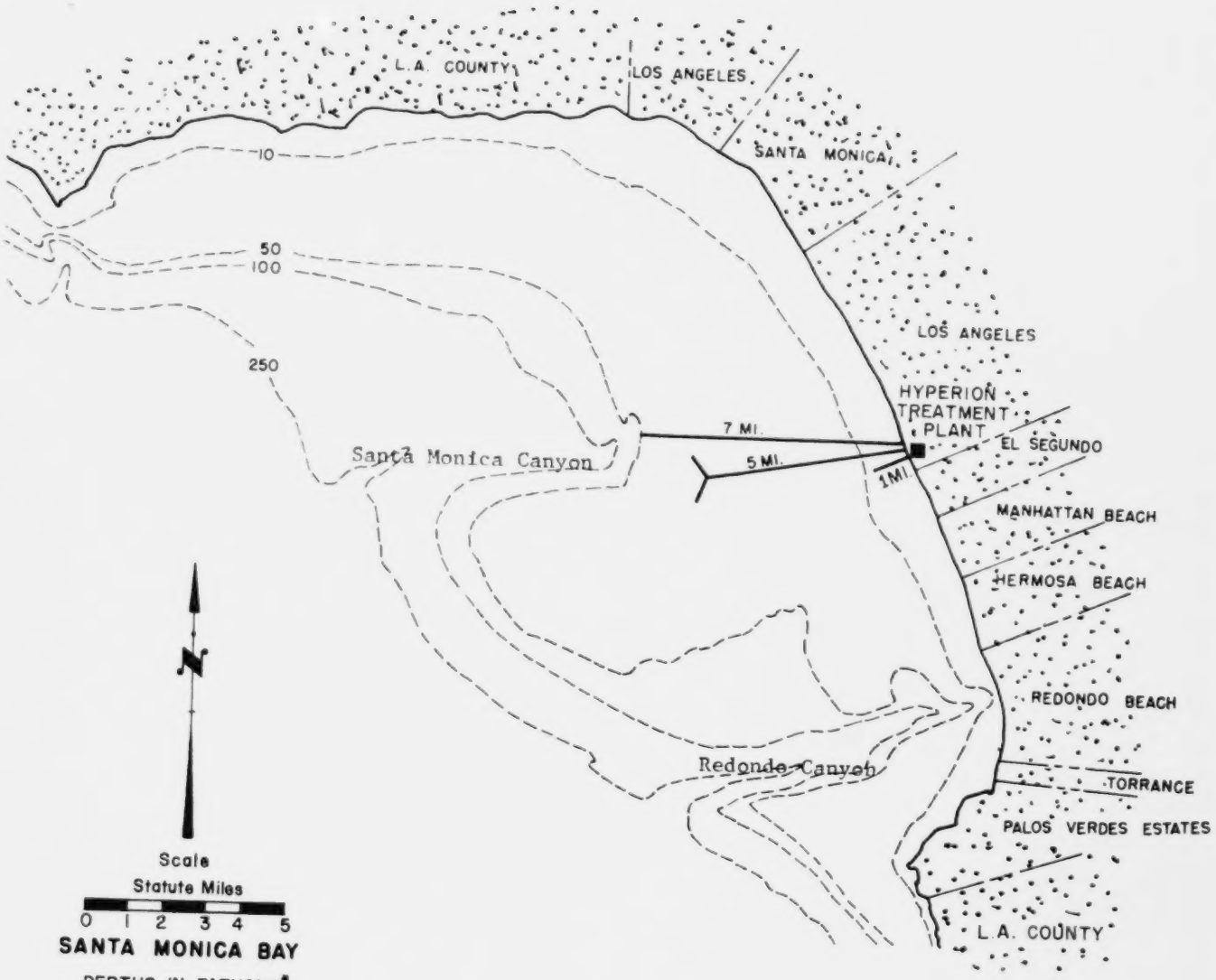


FIGURE 4-1

*1 FATHOM = 6ft.

7-801

4.1.2 Sludge Outfall and Discharge Area Description:

The location of the three Los Angeles City outfalls is shown on Figure 4-1. The Hyperion sludge outfall is a two-foot-diameter sewer called the Seven Mile Outfall, extending into the Pacific Ocean west of the Hyperion Sewage Treatment Plant for 6.7 miles, terminating at the depth of 300 to 320 feet near the rim of underwater Santa Monica Canyon.

4.1.2.1 The discharge of sludge was designed as a buoyant jet. This means that the discharge of the sewage solids/wastewater mixture is expected to rise, spread, and mix with seawater until it reaches either the water surface or the thermocline. (The thermocline, which is usually present, is the dividing plane between two layers of water of different density. The thermocline acts as if there were a barrier preventing free movement from one layer to another.) In either case, only the largest particles would be expected to drop out of the plume before the sewage sludge plume rises to its maximum height.

4.1.3 Fate of Discharged Sludge Materials:

4.1.3.1 The fate of most of the sludge discharged from the City's Seven Mile Outfall is unknown. Probably less than 5% of the solids settle within two kilometers of the outfall.

4.1.3.2 It appears that even the heavier sludge particles do not settle uniformly on the ocean bottom, but are swept into various areas, perhaps even out of the canyon area. Figure 4-2 shows how the sediment types vary in the most heavily affected area. Deposits of sludge vary in depth, but one foot of depth is most commonly reported, with the maximum sludge depth reported as over two and a half feet deep.

4.1.3.3 Figure 4-3, which shows where sediments have sulfide odors, correlates well with previous Figures showing areas of sludge deposits and with Figures III-B-21 to III-B-28 in the Los Angeles City Wastewater Facilities Plan Environmental Impact Statement which shows areas of high metal concentrations.

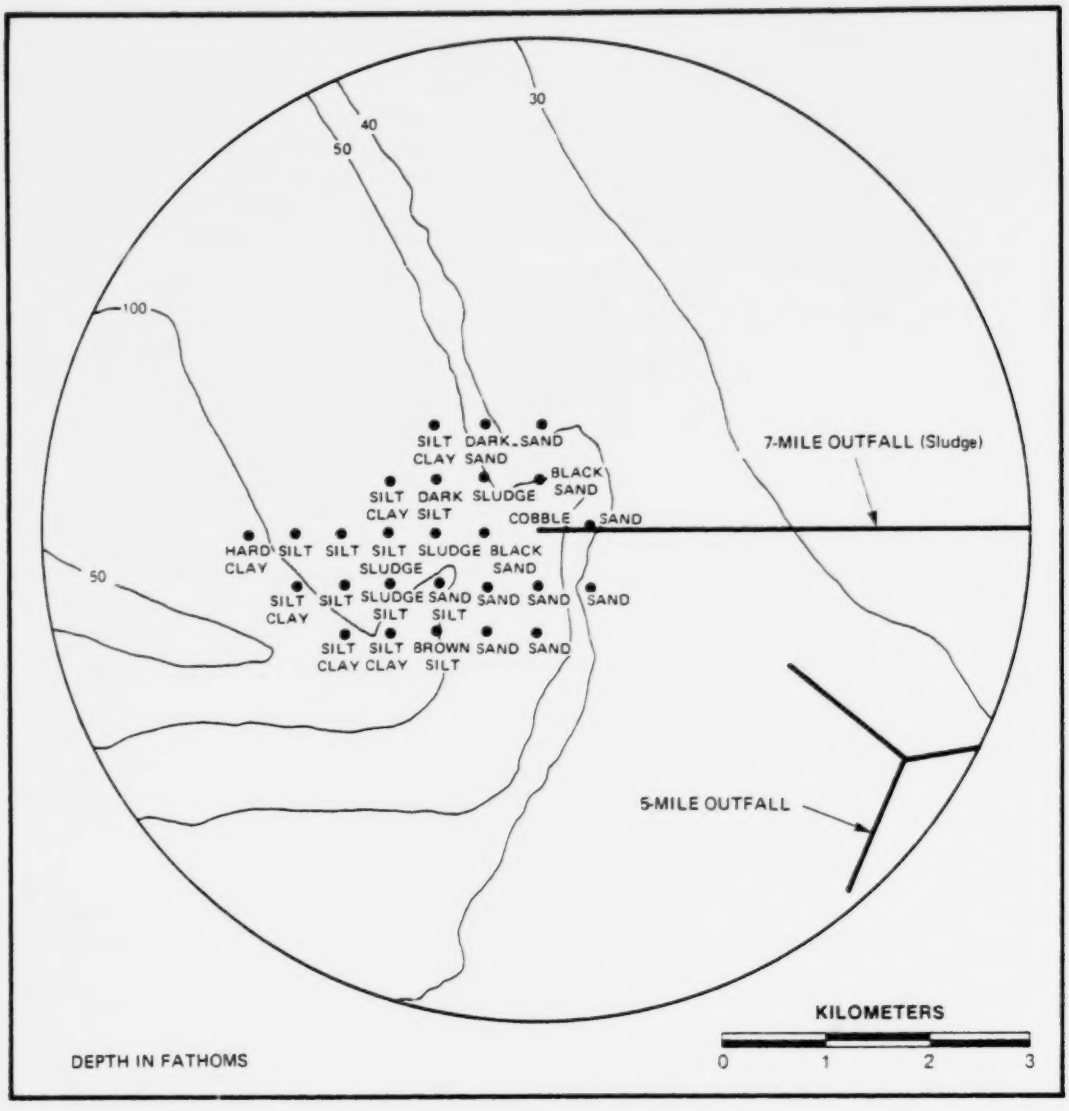


Figure 4-2 Sediment type judged subjectively at the time of sampling (25 March 1976) by SCCWRP personnel (unpublished data provided to HDR by H. Schafer, SCCWRP).

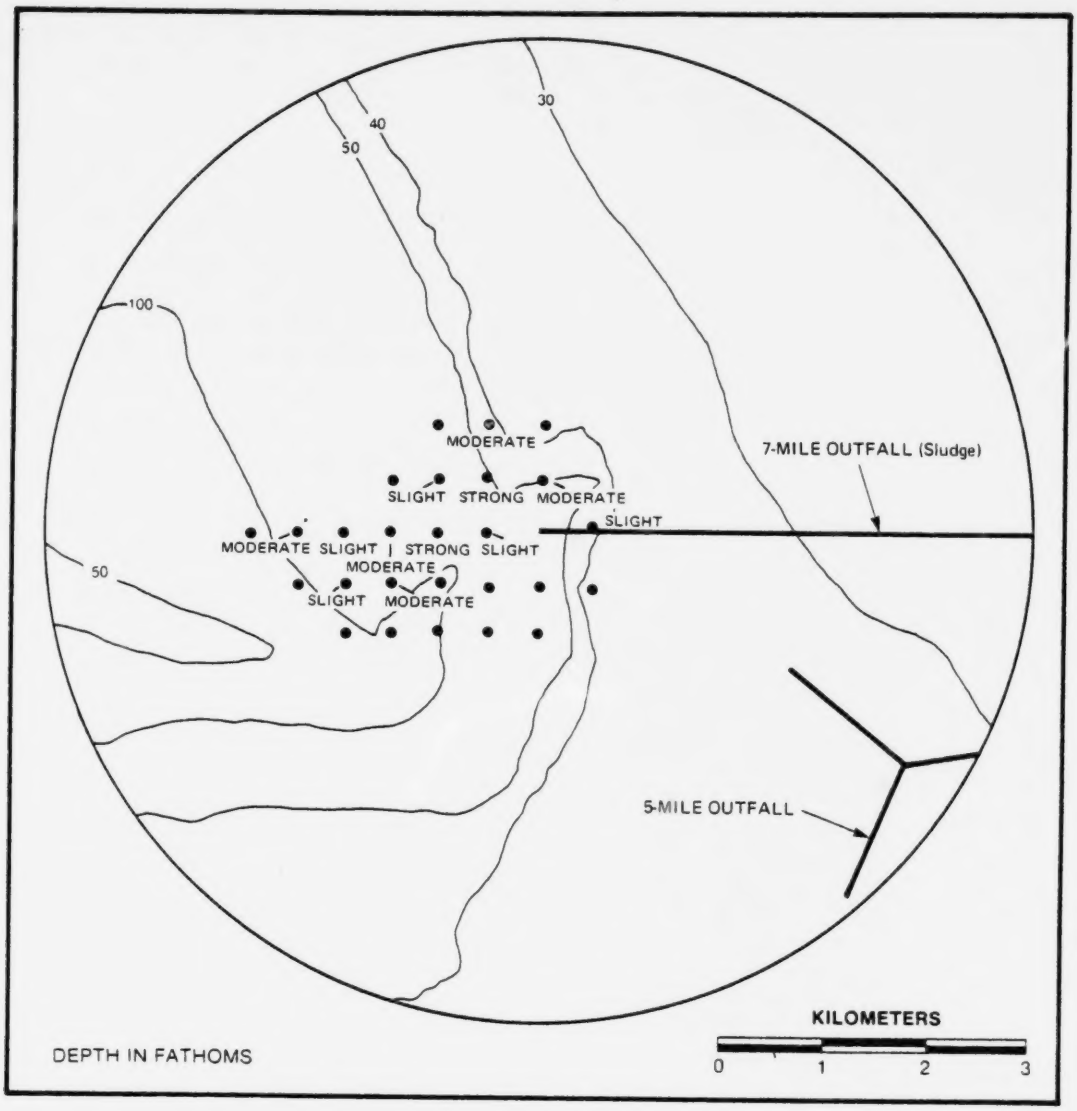


Figure 4-3 Sulfide smell measured subjectively at the time of sampling (25 March 1976) by SCCWRP personnel (unpublished data provided to HDR by H. Schafer, SCCWRP).

From the above-referenced figures, sludge appears to settle out of the plume both upcanyon and downcanyon of the discharge point. Also, sludge apparently tends to travel northwest (cross-canyon) at the 100-meter depth.

4.1.3.4 The previous discussion centered on the larger particles of sludge materials which settle, at least initially, in the upper portion of Santa Monica Canyon; however, the fate of the remaining 95% or more of the solids discharged is largely unknown. The settling velocities of these smaller particles is extremely low, on the order of 10^{-2} to 10^{-4} centimeters per second.

4.1.3.5 At such low settling velocities, the sludge particles would not be expected to separate themselves from the rising sludge plume. After reaching its maximum height, the plume containing all but the very largest particles will move with prevailing currents, while the particles begin to settle to the ocean bed. Where these particles ultimately land is dependent on the general flow patterns of Santa Monica Bay and the currents of Santa Monica Canyon.

4.1.4 Ocean Currents Near Outfall

4.1.4.1 Very little information exists on the currents in subsurface Santa Monica Canyon. In 1962, Hume, Gunnerson, and Imel reported a 0.5 knot (26 cm/sec) current at 300-foot depth directed up, and then down, the axis of the Canyon. They also hypothesize that a cold zone of water which they found in the Bay may have been fed by water coming up from Santa Monica Canyon and from sub-surface Redondo Canyon. They also noted the almost continuous appearance of cold spots in the surface waters around the head of the Santa Monica Canyon. SCCWRP, in 1973, reported Shepard and Marshall's 1972 data on a number of canyons along the west coast. They noted that most canyons showed a predominating downcanyon flow except for Redondo Canyon. No data on Santa Monica Canyon was presented. SCCWRP, in 1977, reported Shepard and Marshall's 1972 data and their own 1974 data on Santa Monica Canyon flows. This information, coming from measurements taken near the foot of the Canyon, indicates a net down-canyon movement.

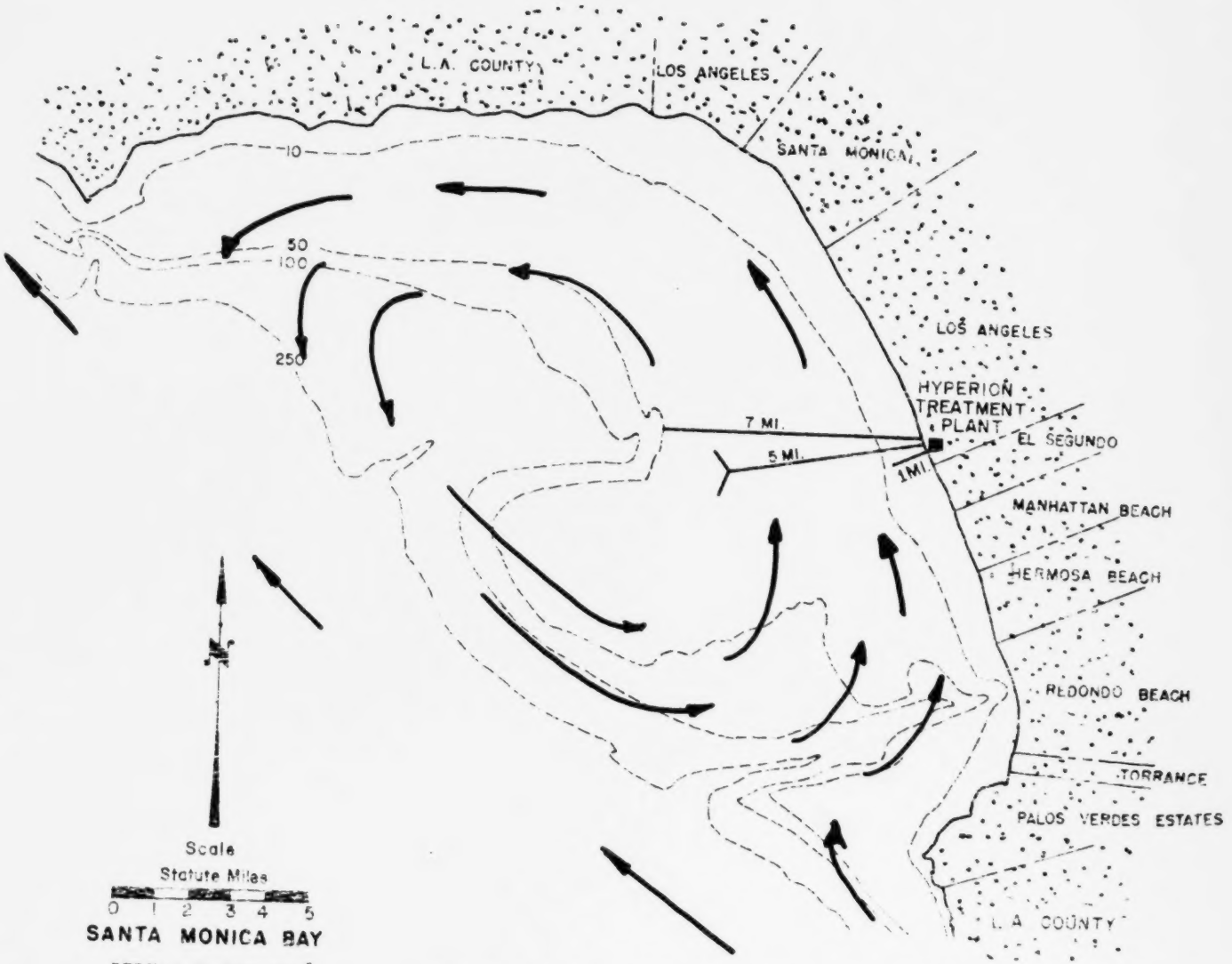


FIGURE 4-4

Surface Currents in Santa Monica Bay (0-100 M)

110.a

4.1.4.2 The Santa Monica Canyon currents near the vicinity of the sludge discharge are not well defined. There may be long periods of time, or seasons, when current flows reverse their normal directions.

4.1.4.3 The shelf currents in the Santa Monica Bay are in a general counterclockwise direction, as shown on Figure 4-4, with flow velocities in the 0 to 20 centimeters per second range. During periods when coastal currents are weak, the onshore winds tend to push water into Santa Monica Bay, causing outflows both to the north and south.

4.1.4.4 As indicated in the above discussions, it is difficult to say with certainty where the bulk of the sludge discharge is ultimately deposited. Additionally, the small particles may be quite easily re-suspended when the bottom currents are sufficiently rapid.

4.1.4.5 A review of Tables III-B-19 to III-B-28 in the draft Environmental Impact Statement for the Los Angeles City Wastewater Facilities Plan appears to indicate that sludge spreads out downcanyon and slightly to the north out of the head of the canyon. This is based on measurement of deposits of metals; it is assumed that the rate of sludge deposits correlates with the rate of metals deposits.

4.1.4.6 It appears that most of the sludge particles go into the general Southern California Bight circulation through outflow from Santa Monica Bay or Santa Monica Canyon, and are not deposited on the ocean floor in any particular area.

4.2 Known Impact on Marine Organisms:

4.2.1.1 One of the most obvious impacts of the sludge discharge is in the change in species composition in the outfall area. There is a significant reduction in species diversity in the immediate area of the sludge (Seven Mile) outfall. See main body of EIS, Figure III-C-16. The low diversity is indicative of a pollution-stressed environment. There is also a reduced biomass of benthic (bottom dwelling) organisms near the sludge outfall, compared to an increased biomass near the Five Mile Outfall (which receives a mixture of primary and secondary effluent). See main body of EIS, Figure III-C-15.

4.2.1.2 A review of the benthic organisms found in Santa Monica Bay shows that only the pollution tolerant sludge worm Capitella capitata thrives in the bottom sediments near the outfall. Figures III-C-21 through III-C-24 from the Los Angeles City Wastewater Facilities Plan Environmental Impact Statement show quite vividly the apparent avoidance that takes place near the sludge outfall. This may actually be the result of the smothering or obliteration of some species or the recruitment of opportunistic species.

4.2.1.3 A comparison of the benthic biomass of several Southern California Bight ocean canyons indicates relatively little life in Santa Monica Canyon. The average benthic biomass of all canyons was 175 grams per square meter as compared to 43 grams per square meter in Santa Monica Canyon and, for comparison, 367 grams per square meter in Redondo Canyon (which is also in Santa Monica Bay).

Information available shows uptake of chlorinated hydrocarbons in mussels, crabs, and dover sole near the Seven Mile Outfall. Similar uptake of heavy metals is not shown to occur in dover sole which are found in the outfall area. It appears likely that the altered species composition is in part a response to various organisms' sensitivity to higher concentrations of various trace metals.

Tables III-C-2 and III-C-3. from the Los Angeles City Wastewater Facilities Plan Environmental Impact Statement shows critical concentrations of trace metals and chlorinated hydrocarbons which can adversely affect various marine organisms.

Of the several types of fish diseases or abnormalities reported in Pacific Coast waters only fin erosion is clearly linked to ocean outfalls. This is because of the high percentages of diseased fish found near the outfall as compared to the percent of disease of the same species found away from the outfall. See main body of EIS, Figures III-C-44 and III-C-45. Both the dover sole and light croaker have been found to have a greater than 10% incidence of fin erosion disease near the Los Angeles City sludge outfall and the Los Angeles County Sanitation District White's Point outfall. Although much research has tried to determine the causative agent of this disease, the critical pollutant has not yet been identified.

An analysis on the impact of nutrients on the standing biomass of fish which could be supported by the Hyperion discharge was made for the Los Angeles City Wastewater Facilities Plan Environmental Impact Statement and is shown on Figure VIII-B-4. Discontinuation of the sludge discharge could theoretically remove one-third of the standing biomass by virtue of the reduced nitrogen discharge to the ocean. (The analysis intentionally overstates the potential impacts, in order to show the most severe impact which could reasonably be expected.) This is not to imply that the reduction in the Santa Monica Bay fisheries will be nearly that great, as there are sources of nitrogen other than those from wastewater.

4.3 Potential Impacts of Continued Sludge Discharge:

4.3.1.1 Continued sludge discharge from the Seven Mile Outfall would be expected to have more significant adverse effect in the future when the entire Hyperion sewage flow receives secondary treatment. More waste activated sludge will be produced by a secondary treatment process in Hyperion, and will be mixed with less effluent than is now used, so the concentrations of metals, phenols, chlorinated hydrocarbons, other toxicants and suspended solids in the sludge outfall would be expected to significantly increase. The Los Angeles City sludge discharge would clearly become the major municipal pollution source on the West Coast as all the other dischargers upgraded to secondary treatment and discharged a higher quality of effluent.

One major impact is the potential threat to health for sports fishermen and others who eat fish containing sludge toxicants.

4.3.1.2 Some diseases not yet shown to be pollution-related might, under the above described situation, be clearly seen as discharge related; however, responsibility for the abnormal conditions that occur might still be difficult to trace back to sewage sludge discharge. This is because the bulk of the pollutants would not settle near the head of Santa Monica Canyon, but would continue to go into Santa Monica Bay and the general Southern California Bight circulation. Moreover,

there will still be pollutants already discharged and in circulation, or already discharged and settled to the bottom sediments and leaching slowly out of those sediments.

4.3.1.3 The inability to prove a direct correlation between an abnormality and a sewage discharge should not encourage inaction when it is known that many of the constituents in the discharge could potentially cause such abnormalities. Sewage sludge contains numerous constituents of serious concern both to public health and to the ecology of the ocean.

4.4 Major Effects of Wastewater Constituents

4.4.1 Settleable Solids--Settleable solids can change the benthic (ocean floor) environment in the immediate vicinity of the ocean outfall and affect benthic organisms by: forming bottom deposits; stimulating bacterial growth which depletes dissolved oxygen; increasing concentrations of hydrogen sulfide which is toxic to marine life; causing other adverse effects because they contain heavy metals, chlorinated hydrocarbons, phenolic compounds, and other organic and inorganic compounds; and serving as organic nutrients which stimulate or inhibit the growth of benthic organisms.

4.4.2 Suspended Materials--Particulate material in suspension may affect marine organisms both directly and indirectly:

4.4.2.1 Direct Effects:

- Decreasing light penetration by absorption and scattering, thereby limiting primary productivity.
- Clogging the gills of marine organisms resulting in impaired respiration.
- Settling on and smothering organisms or resulting in adverse environmental conditions by creating a high oxygen demand.

4.4.2.2 Indirect Effects:

- Carrying toxic constituents such as heavy metals and chlorinated hydrocarbons which can accumulate in marine sediments or be consumed and incorporated into the body tissues of marine organisms.
- Serving as food for marine organisms and having biostimulatory effects if toxicants do not result in overall reduction of productivity.

4.4.3 Floatable Materials

4.4.3.1 Oil and Emulsions:

- Adhere to the gills of fish and thereby interfere with respiration and cause asphyxiation.

- Coat aquatic plants (such as kelp and other algae) and interfere with their respiration.

- Form surface slicks which can impair gas transfer between the atmosphere and ocean surface, entrap and asphyxiate pelagic organisms such as plankton, and form aesthetically objectionable surface and onshore deposits of grease and oil.

4.4.3.2 Floating Particulates:

- Shield pathogenic organisms from disinfection or prolong their survival in seawater. This poses a potential public health hazard if contaminated wastes are ingested by swimmers or persons playing along the beach.

- Attract and serve as a contaminated food source for seabirds.

4.4.4 Toxicity--The pollutants present in municipal wastewater discharges can have toxic effects on marine life. These effects can be acute (occurring within a matter of minutes, hours, or days) or chronic (where the effect takes longer to manifest itself). The effects range from sublethal effects on respiration, physiology, growth and development, or reproduction, to lethal effects. Pollutants acting alone or in combination with other factors may stress or weaken an organism so that its chances of survival are reduced. Sublethal chronic effects are difficult to diagnose and harder to predict due to the low and uncertain level of causative pollutants.

4.4.5 Trace Metals--Trace metals in wastewaters can have toxic effects on marine organisms living around the sludge outfall. Data collected indicate the following:

- A large percentage of the metals in treated wastewaters are attached to suspended solids or other particulate matter.

- Upon discharge, metals can either be released into solution, ingested with organic material, be incorporated in sediments with organic material or be bioaccumulated.

- Concentrations in sediments range from 2 to 270 times higher than background, near the sludge outfall.

- Trace metals concentrations tend to decrease with distance from the outfall.

- There is concern over second- or higher-order effects as a result of biomagnification of metals, especially cadmium, which can be concentrated to high levels and eventually result in adverse effects to the higher levels of living creatures including man.

4.4.6 Chlorinated Hydrocarbons, (many pesticides, polychlorinated biphenyls--PCB's--, and other organics such as chlorobenzenes) can have a number of toxic effects on marine organisms. Current information indicates that:

4.4.6.1

- DDT and its derivatives and PCB's are detectable in all levels of marine food webs in Southern California coastal waters as a result of uptake and bioaccumulation and deposition in marine sediments.

- Municipal wastewaters constitute the most significant local sources of both pollutants. With source control and limitations on PCB usage, the output has decreased significantly.

- There is a strong association between high levels of total PCB and fin erosion in Dover sole. PCB may act with heavy metals or other pollutants to produce the disease symptoms. The cause of fin erosion has not been firmly established.

- Water column studies near the sludge outfall using previously uncontaminated shellfish (bay mussels) indicate that in several weeks DDT and PCB's accumulate to concentrations exceeding 0.62 ppm wet weight.

- PCB's are of low acute toxicity to humans; however, they are suspected to be cancer-causing agents. A high percentage of the population has accumulated detectable quantities of PCB's.

4.4.7 Other Synthetic Chemicals--Pthalic acid esters, carbamate pesticides, and possibly other chemicals of whose presence in the ocean we have very little information, may be identified in the future as sources of adverse impacts.

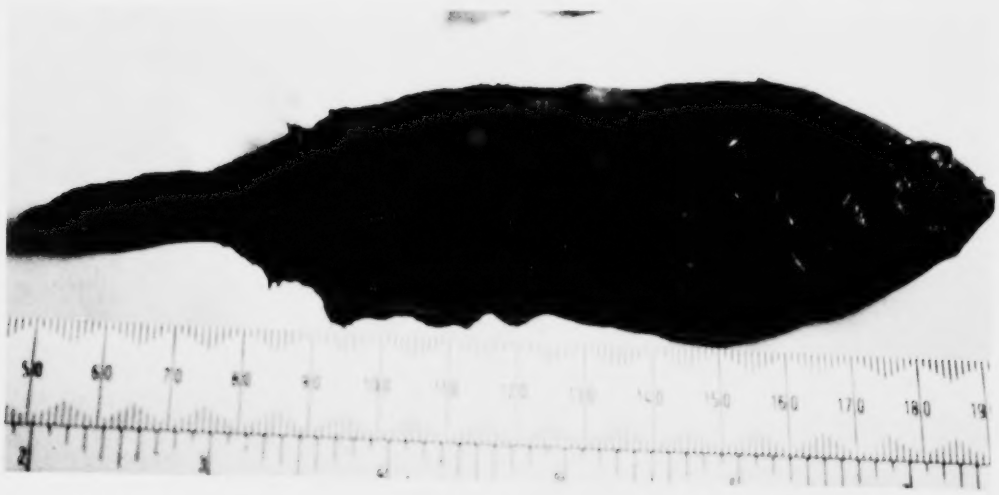
4.5 Disease in Marine Organisms--The possibility that wastewaters discharged into coastal waters are responsible for diseases and abnormalities in fishes and other marine organisms has generated much concern and stimulated local research on this subject. Fin erosion, skeletal deformities, lesions, fungal infections, physiological changes and tumors have been found in marine animals. Each of these afflictions and its possible relationship to general ocean pollution is discussed below.

4.5.1 Fin Erosion--(See Figure 4-5) The most serious affliction identified is fin erosion, found among Dover sole and a few other benthic fish species. Data collected by the Southern California Coastal Water Research Program (SCCWRP) and the various dischargers have shown that:

4.5.1.1 - The Palos Verdes Shelf is the primary site at which fin erosion occurs in the Dover sole, with incidence as high as 77 percent at certain sampling stations nearest the Los Angeles County Sanitation District's outfalls. Incidence among Dover sole in Santa Monica Bay where the sludge outfall is located is much lower (ten percent).

4.5.1.2 - Laboratory studies of the tissues of affected species support the hypothesis that the disease is not of bacterial origin.

4.5.1.3 - Laboratory experiments show that adverse changes in fin condition can be induced in Dover sole by exposing healthy fish to contaminated Palos Verdes sediments.



Fin erosion afflicts Dover sole and white croaker and other species (shown above) living in the vicinity of ocean outfalls and areas of waste discharge. Incidence near the LA City sludge outfall is approximately 10% for both Dover sole and white croaker. At least eight other species are affected in the Santa Monica Bay.

LARGE EPIDERMAL PAPILLOMA ON A JUVENILE DOVER SOLE
Microstomus pacificus

These tumors are widespread and have not been correlated directly with wastewater outfalls but may be a result of ocean pollution by synthetic chemicals or a natural phenomena.

Figure 4-5

4.5.1.4 - A preliminary comparison of the trace constituents in Dover sole and starry flounder from Washington State, with and without fin erosion, suggests that total PCB is elevated in the tissues of diseased individuals of both species.

4.5.2 Tumor Diseases--(See Figure 4-5) Two species of fish (Dover sole and white croaker) caught near ocean outfalls have been afflicted with epidermal papillomas, a type of benign tumor on the surface of the body. These tumors appear to be related only to these species.

Whether this disease is influenced by waste discharge practices is not known. The frequency of occurrence of tumors in fish in the Southern California Bight (coastal waters) is at the lower end of the range reported for the Pacific Coast.

4.5.3 Invertebrate Diseases--Lesions of an unknown cause have been found on specimens of crabs collected during trawls in Santa Monica Bay during 1971-72. Although a bacterial origin has been suggested as the cause, contaminated sediments may also be a factor. Sea urchins in the Southern California area have been found to have extensive yeast-like fungal infections which resulted in death of some organisms. The cause of the infection has not been identified, but it may be related to marine pollution.

4.5.4 Mammal Diseases--There is evidence that PCB's or other chlorinated hydrocarbons may be implicated as causative agents in the syndrome of premature birth found among sea lions living on California's offshore islands.

4.5.5 Bird Diseases--Marine birds, such as the Brown Pelican nesting on California's offshore islands, have suffered from the inability to lay hard-shelled eggs. Evidence supports the theory that DDT or PCB's may be the causative agents. In recent years following cessation of the major DDT discharge, there has been less incidence of soft-shelled eggs.

4.6 PUBLIC HEALTH AND WATER QUALITY

4.6.1 Contamination by Microbes and Viruses

Pathogenic bacteria and viruses present in undisinfected sludge, as now discharged by Los Angeles City to the marine environment, may constitute a potential public health hazard. The pathways of infection in humans include recreational use of contaminated waters and eating shellfish that have concentrated the microorganisms. On occasion, beaches and shellfish beds along the California coast have been closed due to microbiological contamination from sewage discharges. No known cases of pathogenic infection have been reported by the State or County Health Department by people using recreational waters where wastewater effluents are discharged.

Man's knowledge of the fate of viruses in the marine environment is limited, but it is known that their survival is enhanced by adsorption to suspended particulates and that they can accumulate in sediments.

One public health concern of the EPA is the role which viruses may play in transmitting genetic information (such as resistance to drugs) to surrounding enterobacteria. Bacterial resistance has been found for at least 10 antibiotics and several other antimicrobials. The transmission of resistance from sewage (wastewater or sludge) to humans occurs via ingestion of contaminated water or poorly cooked fish and shellfish. Upon ingestion, resistance is transferred to the normal resident flora (fecal coliform) maintained in the host intestine.

The potential human health hazards associated with present waste discharge practices are not of a direct, quantifiable nature. There have been no epidemiological studies to determine the risk to consumers from eating shellfish caught along Los Angeles County beaches or the risk of contracting a disease while swimming in local waters.

4.6.2 Heavy Metal Contamination of Seafood

Several metals that are concentrated by fish and invertebrates are known to have toxic effects in humans. The metals of particular concern are mercury and cadmium, although lead may also affect humans.

Recent local studies have shown that rock scallops exposed to municipal wastewater discharges appear to be able to concentrate at least seven potentially toxic trace metals (silver, cadmium, chromium, copper, nickel, lead, and zinc) in their gonadal and muscle tissues to levels at least twice normal concentrations. However, it is not known to what degree the elevated metals concentrations affect either the scallop, or its predators including man.

4.6.3 Chlorinated Hydrocarbons in Seafoods

The potential for biomagnification of chlorinated hydrocarbons, particularly those from wastewater discharges, is of much concern. EPA has banned or limited the use of many chlorinated hydrocarbons known to have adverse effects on health and the environment. Some of these (such as DDT, aldrin, dieldrin, heptachlor, and chlordane) have been banned as potential carcinogens. The dramatic increases in chemically induced cancers during the last half-century indicate that much more care needs to be exercised in the use of chemicals and in the control of potential environmental pollutants.

Seafoods, including commercial and sport fish caught in the coastal waters of Southern California, have been found to contain levels which exceed the U.S. Food and Drug Administration (FDA) recommended guideline tolerance of 5.0 ppm wet weight of total DDT. Fishery products including Pacific bonito, white croaker, and canned Jack Mackerel, have been condemned in the past. Because of increasing evidence on the adverse effects of PCB's, the U.S. Food and Drug Administration, on April 1, 1977, proposed a lowering of the 5.0 ppm limit to 2.0 ppm.

Analyses are routinely performed to determine the chlorinated hydrocarbon content of fish in the vicinity of the Seven Mile Outfall. The data collected show that Dover Sole muscle tissues contained a median of 2.0 ppm PCB in the 1974-75 trawls.

4.7 In summary, there is a large body of evidence indicating that ocean discharge of sludge adversely affects the marine environment.

5.0

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